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AMERICAN AND OTHER PATENTED INVENTIONS.

MARCH, 1835.

Remarks and Calculations on the Best Form for Railway Bars, and on the defects which exist in the present method of supporting the same. By R. Stephenson, *Engineer.*

(Concluded from p. 79.)

On a comparison of the chairs required for these two descriptions of rail, it will be found that they differ considerably in the depth of the recess for receiving the rail, that for the parallel rail being deeper, and the whole body of the chair higher, thus elevating the centre of gravity of the rail above the bearing surface at the bottom of the chair. Now, the chair for the elliptical rail is lower by a quantity equal to the swell of the rail, which of course brings the centre of gravity of the rail nearer to the bottom of the chair. This difference in the construction of the chair renders lateral blows less effective in straining it, and contributes much to the steadiness of the rail in the vertical position, supposing each fitted with equal care and accuracy.

When the period arrived for laying down the rails on the Newcastle and Carlisle Railway, a difference of opinion existed amongst the engineers consulted by the Board of Directors. This occasioned them to resort to actual experiment upon rails, expressly made by

the advocates of each class. They weighed 50 lbs. per lineal yard, and were designed of the form and dimensions deemed most suitable for such a trial, by each party. The following table describes each experiment, with every detail. The care taken throughout the experiments is evinced by the minutiæ of the measurements, the deflexion being ascertained to be less than the $\frac{1}{1000}$th part of an inch at every increase of load.

Experiments on the Comparative Strength of Different Malleable Iron Rails, October 10th, 1832.

Fish-bellied rail, length 15 ft. 9 3-4 inches, weight 262 lbs., equal to 49.3 lbs. per yard.						
Weights applied midway between bearings, in cwts.	Bearings in 3 ft., 0 15-16 in. apart.		Bearings, 6 ft. 0 5-8 inch apart.		Bearings, 3 ft. 9 3-16 inches apart.	
	Deflexion, 20 in. from one bearing, and 16 15-16 in. from the other.	Deflexion, 11 in. from one bearing, and 25 5-16 in. from the other.	Deflexion, 34 1-8 in. from one bearing, and 38 4-8 in. from the other.	Deflexion, 29 1-2 in. from one bearing, and 43 1-8 in. from the other.	Deflexion, 21 1-16 in. from one bearing, and 24 1-8 in. from the other.	Deflexion, 15 1-8 in. from one bearing, and 30 1-16 in. from the other.
20	2	2	17	17	5	4
34	4	4	43	38	9	8
48	6	5	63	60	15	14
62	9	8	89	81	21	19
76	12	11	112	94	29	25
90	16	14	121	110	35	31
104	19	16	156	144	42	36
118	22	19			48	41
132	25	21	Perm.	Perm.	56	46
146	28	23	Defl'n,	Defl'n,	63	54
160	32	27	12.	12.	69	61
174	35	29			76	68
188	37	30				
202	41	33			Perm.	Perm.
216	44	35			Defl'n,	Defl'n,
230	48	36			3.	3.
	No permanent deflexion.					

Deflexion measured in 1088th parts of an inch.

Experiments on the Comparative Strength of different Malleable Iron Rails, October 10th, 1832.

Parallel rail—length 15 feet 10 1-8 inches; weight 256 lbs. equal to 48.47 lb. per yard.						
Weights applied midway between bearings, in cwts.	Bearings, 3 ft. 0 15-16 inch apart.		Bearings, 6 ft. 0 5-8 inch apart.		Bearings, 3 ft. 9 3-16 inch apart.	
	Deflexion, 20 in. from one bearing, and 16 15-16 in. from the other.	Deflexion, 11 in. from one bearing, and 25 15-16 in. from the other.	Deflexion, 34 1-8 in. from one bearing, and 38 4-8 in. from the other.	Deflexion, 29 1-2 in. from one bearing, and 43 1-8 in. from the other.	Deflexion, 21 1-16 in. from one bearing, and 24 1-8 in. from the other.	Deflexion, 15 1-8 in. from one bearing, and 30 1-16 in. from the other.
20	3	3	14	14	8	6
34	8	6	40	37	16	14
48	13	10	69	67	24	21
62	18	12	84	79	32	28
76	23	16	110	104	41	32
90	28	20	138	131	48	39
104	34	23	161	153	55	45
118	38	26			60	50
132	43	30	Perm.	Perm.	69	58
146	47	34	Defl'n,	Defl'n,	78	65
160	50	40	4.	3.	87	72
174	55	41			97	80
	Perm. Defl'n 3.	Perm. Defl'n, 2.			Perm. Defl'n, 9.	Perm. Defl'n, 8.

Deflexion measured in 1088th parts of an inch.

Fish-bellied rail, equal to 40.6 lb. per yard.		
Weights applied midway between bearings, in cwts.	Bearings, 3 feet 0 1-4 in. apart.	
	Deflexion, 20 inches from one bearing, and 16 1-4 in. from the other.	Deflexion, 11 inches from one bearing, and 25 1-4 in. from the other.
20	4	3
34	8	7
48	14	11
62	20	17
76	26	23
90	31	28
104	37	31
18	44	38
132	51	44
146	58	50
160	66	55
174	72	61
	Perm. Defl'n, 6.	Perm. Defl'n, 4.

Deflexion measured in 1088th parts of an inch.

On examining the table, it will be seen that the deflexions were measured at a short distance on each side of the centre, between the bearings. This arose from the circumstance of the weight being applied at the centre, which, of course, rendered it inconvenient to apply instruments at that point for measuring the quantity of deflexion.

Without noticing the results at each addition of weight, as detailed in the table, which is sufficiently explanatory in itself, it may answer our present purpose to take the results indicated when that weight, which will probably be the maximum in practice, was applied, say 62 cwt. With this weight, the bearings three feet apart, and each rail equal to very nearly 49 lbs., the deflexion of the elliptical rail is to the deflexion of the parallel rail, as eighteen to thirty, nearly.

If the comparison of the other deflexions exhibited by the table be followed up, it will be found that they do not differ essentially from the above ratio.

If the weights producing permanent deflexion (or that point where the elasticity of the material is destroyed) be compared, it is scarcely less decisive; for we find that 174 cwt. produced a permanent deflexion of three in the parallel rail, whereas 230 cwt. did not reach this point with the elliptical rail.

Referring again to the table, there is only one other point to which I would beg particularly to direct attention, as it seems to corroborate what has previously been stated, respecting the impropriety of relying upon any ordinary railway bar for supporting the load, when the bearings are six feet apart. I allude to the deflexion which takes place with the weight of 62 cwt. placed on the parallel rail, when the distances between the bearings are increased to six, instead of three, feet. Here we find, at $34\frac{1}{8}$ inches from one bearing, and $38\frac{1}{8}$ inches from the other, the deflexion amounted to $\frac{84}{1088}$ of an inch, which, in round numbers, may be taken at one-tenth of an inch at the middle point.

Now, it must be borne in mind that this result is with a weight perfectly stationary, and, consequently, unassisted, in any way, by percussion; whereas, a similar load, moving on a railway, oscillates upon the springs of the engines, or carriages, and would produce an effect greater than $\frac{1}{10}$th of an inch, but permanent deflexion would take place at considerably less than $\frac{2}{10}$ths of an inch. We thus have it demonstrated, how essential it is to preserve the blocks at a uniform level with malleable iron rails, otherwise the texture of the iron must soon become permanently destroyed. It also proves how seldom we can take advantage of that which is said to be the chief advantage of the parallel rail, and that only when the railway is in improper order, in which case (as the experiments most distinctly prove) there will be great risk of permanent deflection.

This brings me to notice an apparent advantage which the parallel rail has over the elliptical rail, but which has never, to my knowledge, been adduced, or much insisted upon. In the parallel rail, any weight, when above a block, or support, is divided more equally over three supports than in the elliptical rail, owing to the greater flexibility of the latter immediately over each block, or sleeper. This, it must be confessed, appears to be a striking advantage; but it must be compared with the fact that, in cast-iron rails, where the flexibility of the rail is reduced to nothing, and where each support in succession bears the superimposed load, without transferring any portion

to the adjoining blocks, the expense of keeping the road in order is less than in malleable iron roads. Hence, it seems fair to conclude that the capability, in a rail, of transferring a portion of the strain to the adjoining blocks, is productive of injurious consequences, which are not adequately compensated for by this apparent advantage.

It is worthy of mention that this view of difficulties, or imperfections, arising out of having a number of bearings under one rail, is supported by a case in the construction of machinery, so nearly parallel, that it may be considered absolutely so, and fully appreciated by every practical mechanic. I allude to the difficulty and risk of placing more than two bearings under one axle-tree. It is found so difficult to keep such a construction in order, that it is scarcely ever adopted, and where the axle is long, it is generally divided into parts, making each bearing, and its portion of axle, independent. Now, this is precisely what is done in cast-iron railways; each support and rail has a duty to perform, which it does, independent of any other.

I am afraid this digression from the point more immediately under discussion, may appear irrelevant, but it is one which I feel is necessary, fully and clearly to explain the views expressed in the foregoing remarks, respecting the flexibility of the rails above the supports, which I hold to be beneficial in more respects than one; for, whilst the strength of the rail is rendered greater in the middle of its length, the height of the chair, and the level of the rail, is reduced, which contributes to the steadiness of the construction.

Having learnt that the elliptical rail on the Liverpool Railway had frequently broken, I wrote to Mr. John Dixon on the subject. The following is an extract from his letter:

"Our old rails, I am convinced, are too weak; not for the wagons, but for engines that bear six tons on one pair of wheels; and the weakest part is evidently the end next a joint, for although as deep at that point as at the places where the other chairs are fixed, it has not the support from the *next rail*, as if it were welded there, or were one continuous bar, especially when the joint chair gets loose on the block, key loose, and the block, or sleeper, itself settles. In fact, they generally bend, or break, within *six or eight inches of the end of the rail.* I believe the best rail for economising iron, would be to make all the rail undulating as usual, but the two extremes parallel, the parallel part to be as deep as the belly of the undulations; but probably this could not easily be made, and would be then only a substitute for a little more iron."

This intelligence induced me to ascertain, by calculation, the weakest point in the Liverpool rail, and compare it with Mr. Dixon's statement. If the calculation accorded with the practice, it is clearly easy to provide against a similar imperfection.

In the accompanying drawing,* figs. 1 and 2 are sections of the old Liverpool rail, weighing 35 lbs. per yard; figs. 3 and 4 are similar views of a proposed elliptical rail, to weigh 50 lbs. per yard. The

* The drawing here referred to did not accompany the manuscript from Mr. Stephenson. Com. Pub.

relative strength of these two rails, at eight inches from the end, is as 6 to 15.3, or rather more than 1 : $2\frac{1}{2}$.

Such an increase of strength beyond those employed on the Liverpool and Manchester Railways, which were used for temporary purposes, and thereby injured, during the execution of the work, would appear to be ample.

If we apply the formula which has already been given for the strength of the rails, to the Liverpool elliptical rail, we shall find that it indicates the weakest point at about nine inches from the end, being, in fact, at that point of the curve where it deviates most from the true ellipse, which would have been equally strong throughout.

Now, the depth of the elliptical rail, at nine inches from the end, is exactly the depth due to a parallel rail of the same weight per yard. We have, therefore, data to calculate what would have been the strength of the parallel rail in the middle of its length, compared with the strength of the elliptical rail at that point, which has been found insufficient for six tons upon a pair of wheels, as stated in Mr. Dixon's letter.

The depth of the Liverpool rail, at the point of fracture may be taken at $2\frac{7}{8}$ inches; whereas the depth of a parallel rail of equal weight, would be three inches; the relative strengths of the two rails, at the usual place of fracture, would be $\overline{2\frac{7}{8}}|^3\ \overline{3}|^3$, or as $8\frac{1}{4}$: 9, in favour of the parallel rail at this point.

Now, to continue the comparison, we must suppose the same load which broke the elliptical rail at seven inches from the end, transferred to the middle of the parallel rail, and calculate its adequacy under these conditions.

Since we find the elliptical rail break at seven or eight inches from the end, where the depth is $2\frac{7}{8}$ inches, we are perhaps near the truth in taking three inches as the proper depth, being the depth of the parallel rail, which we have just shown has the advantage over the other in the ratio of $8\frac{1}{4}$: 9.

We know also that the strain produced by the same weight, placed in different parts of a beam, is as the rectangle of the segments into which the beam is divided; the comparative strains, therefore, produced by a given weight, seven inches and eighteen inches from the end, will be as $7 \times 29 : 18^2$, or as 5 : 8, very nearly.

Taking, therefore, the strength of the parallel rail as correct, at seven inches from the end, it must be too weak in the middle, in the proportion of 8 to 5; and we may, consequently, from these premises, draw the following conclusions, viz: Had the Liverpool Railway been laid with parallel rails, 35 lbs. per yard, the breakage would have been increased in the ratio of nearly 5 : 8, and the place of fracture would have been midway between the bearings, instead of seven or eight inches from the end. If we take the weakest part of the elliptical rail, as calculation gives it, viz: nine, instead of seven inches, then the proportional breakage would have been as 6 : 8.

I am fully aware that some risk is incurred in thus endeavouring to represent numerically a comparison which is perhaps not suscep-

tible of rigid calculation; but I am anxious that the truth on this much disputed point should be elicited, and in this attempt to establish a comparison upon grounds partly experimental and partly theoretical, it is believed a numerical statement will tend to define that which I am not aware has hitherto been more than mere matter of opinion, and thus bring the subject more within the grasp of legitimate argument.

In concluding these remarks, I beg leave to state that, if I have in any part of them, betrayed a bias in favour of the elliptical rail, without a sufficiently powerful reason, I shall have pleasure in hearing it pointed out, with a view to correction. I have endeavoured sincerely to give the subject that impartial consideration which its importance demanded, and I need scarcely add that it has given me some satisfaction to find that the experimental and theoretical results coincide sufficiently. This satisfaction is enhanced, when I find that the conclusion in favour of the elliptical rail is consistent with the opinion and experience of Mr. John Dixon, of the Liverpool and Manchester Railway—of Mr. Thomas Storey, the engineer on the Stockton and Darlington Railway—and of Mr. Nicholas Wood, one of the Directors of the Newcastle and Carlisle Railway, to whom I am indebted for the table of experiments embodied in these remarks. The circumstances which gave rise to these experiments have already been explained, and I am enabled, through the kindness of Mr. Wood, to add a copy of the report of the deputation from the Board of Directors of the Newcastle and Carlisle Railway, appointed to examine the subject by experiment. I also add copies of letters received from Mr. Wood and Mr. Storey.

Copy of Report of Deputation alluded to above.

Result of trials made at Walker Foundry, Oct. 10th and 31st, 1832, to show the comparative merits of Fish-bellied and Parallel Rails.

"Various experiments were made, but those which appear to the committee to have more immediate reference to the views of the directors, are the following.

"Three trials were made of fish-bellied rails, of 50 lbs. per yard; three trials of parallel rails of the same weight, and two trials of fish-bellied rails, weighing 40 lbs. per yard.

"The weights laid on in these trials reached different amounts, but 90 cwt. is taken in the following for each trial, which the committee conceive to be a load sufficient to meet any practical object. The weight of the steelyard was 6 cwt., and 14 cwt. was added each time; the measure of deflexion was taken in parts, 1088 of which go to an inch.

"The first six loads (90 cwt.) on the three trials of 50 lbs. fish-bellied rails, measured 164½ parts of deflexion, which give an average of 9.14 parts as the mean advance on each 14 cwt. loading.

"The first six loads (90 cwt.) on the three trials of 50 lbs. parallel rails, measured 230 parts of deflexion, or an average of 12.77 parts mean advance for each 14 cwt. loading.

"The first six loads (90 cwt.) on the two trials of 40 lbs. fish-bellied rails, measured 185 parts of deflexion, averaging 15.41 parts mean increase of each 14 cwt. loading.

"Rejecting fractional figures, the committee consider these results to show, under the circumstances stated, that a fish-bellied rail of 45 lbs. per yard is equal to a parallel rail of 50 lbs. per yard, because, as just expressed, nine parts represent the 50 lbs. fish-bellied rails, twelve parts the 50 lbs. parallel, and fifteen parts the 40 lbs. fish-bellied, bringing the parallel, as nearly as need be, midway between 50 lbs. and 40 lbs. fish-bellied rails."

(Signed,) B. Thompson,
N. Wood,
R. W. Brandling,
W. Losh,
Jas. Thompson,
Fras. Giles,
W. Woods.

Copy of a Letter from Mr. Wood.

Killingworth, 24th May, 1834.

My dear Sir,—As the information you required was the result of private experiments, I did not like to give it until I had the sanction of the directors, which I now have. The experiments were occasioned by a difference of opinion whether parallel or fish-bellied rails were best. and, to bring the question before the directors in the most decisive manner, experiments were ordered to be made upon both rails—Mr. B. Thompson furnishing the section of parallel, and the fish-bellied being furnished by myself. Enclosed are the sections, by which you will see that the wearing surface, or top, of the rail, and the base, were precisely the same; the extreme depth of the parallel being 4 in., fish-bellied 5 in.; the base of the latter being a semi-ellipse, $3\frac{1}{2}$ in. deep, $1\frac{1}{2}$ in. from the end of each three feet, the curved knob being three inches. The experiments were conducted with the greatest care, and the deflexion measured in 1088th parts of an inch. The weights were added 14 cwt. at a time, upon 6 cwt., the weight of the steelyard.

Taking the first 96 cwt. laid upon the middle of the rail, the rail being supported at each end, the deflexion was $\frac{55}{1088}$ parts of an inch, fish-bellied; $\frac{77}{1088}$ parts of an inch, parallel, of 50 lbs. per yard each; and $\frac{98}{1088}$ parts of an inch 40 lbs. fish-bellied; although the conclusion come to by the directors was, that the parallel 50 lbs. was equal to the mean between the 50 and 40 lbs. fish-bellied, viz: $\frac{55 + 98}{2} =$

76½ 1; the comparative stiffness of 50 lbs. parallel and fish-bellied rails, was as 55 : 77.

As, however, the directors took every thing into consideration, the form of the two rails, the fact that the saving of material in fish-bellied being only in the keel of the rail, the conclusion that a 45 lbs. fish-bellied is equal to a 50 lbs. parallel, is, I believe, a just estimate of their comparative merits. We have found the circular knob an excellent form for securing a good material of iron, as it is difficult to form with the common iron. Any other information on the subject, I shall be happy to give you.

I am,

My dear Sir,

Yours, very truly,

To (Signed,) Nich. Wood.

Robert Stephenson, Esq.

Extract from Mr. Storey's Letter.

St. Helen's, Auckland, May 31, 1834.

Dear Sir,—In reference to the subject of the form of rail best suited to railways. On the Stockton and Darlington Railway, you know we have only the fish-bellied kind, which form I have invariably supported, as the strongest, and best suited for railways, with the least weight of material in them, and liable to be the least affected by lateral blows, on account of the point of support being nearest the centre line of the mass of iron forming the rail.

One point is settled with me—that the better the quality of iron, the less it is suited for railway bars.

I have used rails made from Scrap No. 2 Mine Iron, with a Swede bar on the top; Cable Iron, manufactured into rails; No. 2 Mine Iron, do.; with none of which I am yet satisfied.

I have lately ordered 250 tons of rails (to replace our light ones) for the Stockton and Darlington Railway Company, to be manufactured in a different way; which, if I succeed in getting of the fish-bellied shape perfect, I am of opinion will be found to answer the purpose.

If I do not succeed in that shape (without faults and cracks on the under side) it is my intention to resort to the parallel rail, as of that shape there can be no doubt of its answering.

The process I have described is, that good strong mine iron is to be used, that has passed through the refinery and puddling furnaces, and reduced, under the forge hammer, from seven to five inches square, before rolling into rails. The price is only a shade higher than if manufactured from No. 2 mine iron *bars*, and 10*s.* per ton more than the parallel bar of the same quality and manufacture.

You will find that very heavy malleable iron rails are subject to rapid decomposition on the surface, until they attain the strength that passing weights will give motion to the particles, when that decomposition will, in a great measure, cease; thereby proving my

theory, that beyond a certain weight is a wasteful and useless expenditure.

Dear Sir,

Yours always, truly,

To (Signed,) Thomas Storey.

Robert Stephenson, Esq.

On the above report to the Directors of the Newcastle and Carlisle Railway, I have little to remark, except to explain the apparent discrepancy which would seem to exist, on comparing the results taken as the basis of the report, with those described by the table furnished to me by Mr. N. Wood. In the report, other trials were alluded to, with which the results are blended, so that the average is below those stated in the table. The other experiments were, I believe, varied by allowing the rails to be placed loosely on the supports, when the superiority of the elliptical rail, as regards stiffness, was not so decided. The table is founded on experiments, where the rail was firmly keyed into the chairs, and was, therefore, more nearly in the condition of a railway in perfect order. This, I apprehend, will account for the relative stiffness of the two rails being stated as 55 : 77, whereas calculation gives it 55 : 85, and, by the table, where the rail was firmly keyed to the supports, it is 55 : 91.

It is also necessary to explain that the elliptical rail was made with a circular projection, which fitted into a corresponding recess in the bottom of the chair, according to Mr. W. Losh's patent. This would render the keying more efficient, and add a little to the rigidity of the elliptical rail.

This may probably account for the stiffness by experiment sometimes exceeding that represented by calculation, which ought not to be the case where the form of the beam is reduced in depth towards the end. The comparative stiffness, however, taken from the average of the experiments, as stated in Mr. Wood's letter, viz: as 55 : 77, does not differ so much from 55 : 85, as to shake our confidence in the theoretical view affording means for a tolerably near approximation.

The relative ultimate strengths are not mentioned in the report, but from the table they may be found to be as 12 : 15, and calculation gives 12 : 16, which is again sufficiently near to show that the principles adopted in the calculations are correct.

In Mr. Storey's letter, he mentions, in a particular manner, the difficulties he has had with respect to the quality of the iron employed in making rails; and though he expresses it as his opinion, that "the better the quality of the iron, the less it is suitable for railway purposes," I am persuaded he intends this to be taken with great limitation, as it is evident he would not mean to convey the converse, viz: that the *worse* the quality of the iron, the *better* it is suited for railway purposes.

Mr. Storey is not alone in the opinion that the railway iron should not be of the best quality; it is urged by many that iron of the best quality is liable to laminate more rapidly than iron of a poorer de-

scription. I cannot say that my experience has led me to this conclusion; yet there may be consistency in rejecting the use of the finest cable iron, as not forming a rail proportionally stronger with the increased expense. I think it not improbable that much of the evil complained of on the Darlington Railway, from the lamination and splitting of the rails, may be owing, in some degree, to the circumstances of the carriages being without springs, and some of the very heavy locomotive engines with springs applied in such a manner, that they operate only to a partial extent.

On the Warrington and Newton, on the Liecester and Swannington, and on the Stanhope and Tyne, Railways, I recommended the rails to be made from *best No. 2 bar iron, entirely free from cinder.* The rails, when manufactured, are, therefore, No. 3 mine iron. This mode of manufacture would give rails of similar quality to those weighing 28 lbs. per yard, laid down on the Stockton and Darlington Railway in 1825, which, I was surprised to learn from the chairman, were in better condition now, after several years wear, than some rails of 40 lbs. per yard, recently laid down.

Experiments, made to determine whether Light exhibits any Magnetic Action. By John W. Draper, *Christiansville, Mecklenburg Co., Va.*

(Concluded from page 85.)

It is not usually known, that so early as the time of Boyle, it had been ascertained, that a piece of amber would become electrified by exposure to the sunbeam, or even to the light of a fire. An experiment of this nature is explicitly detailed in his writings. I have verified the fact in the case of certain chrystals. A ruby from Ceylon, a rolled sapphire, a tourmaline, a Brazilian emerald, and a topaz, were each insulated on a fibre of gum lac, and exposed for a short time to the sunbeam. They were all found to be electrical, and would attract a very delicate fibre, at the end of an insulating handle, and then repel it. With a piece of amber the same result was not obtained, owing perhaps to the imperfection of the specimen. Now it may be said, that this development of electric tension, arose from the calorific action of the sunbeam, and was not dependant on any action of the light. But to this I answer, that when the same bodies were exposed to the action of heat, in the same degree, none of them gave any signs of electricity, except the tourmaline and the topaz, while the ruby, which was the most active in the sunshine, exhibited no attractive force.

It is extremely difficult to electrify a piece of glass by exposure to the sunbeam, so as to attract a hair or other light body. I noticed however, at certain times, that glass could be made to exhibit electric attraction, by exposure to the sun, but this was by no means a constant effect; the uncertainty depending chiefly on the proneness of the glass to become moist, and partly to the rigidity of the little electroscopic fibre. To remedy this, I had recourse to gold leaf, but un-

successfully. A leaf of gold has considerable inertia; it experiences much resistance to motion from the air, and besides is inconveniently unmanageable in such an experiment. Now if we could substitute for it any thing of less weight, and more perfect mobility, a more certain result might be obtained. It struck me, that a cloud floating in the atmosphere, was possessed of all those properties of which I was in search, extreme mobility and extreme lightness; but how to form such an arrangement was not so easy to contrive. At last I concluded to float a cloud of the vapour of iodine, in a close vessel of atmospheric air, which is of less specific gravity than the vapour, and has no chemical action upon it. The motions of such a cloud are easily discovered by its deep violet tint, and I expected as its particles were heavier than those of the atmosphere, which swam upon it, that it would accumulate on the electrified side of the glass, and displacing the air, pile itself against the surface.

Accordingly, I formed such a cloud, by means of heat, in a clear, dry tube of glass, and exposed it to a beam of light, coming through a hole in a dark chamber. The instant the light fell upon it, a far more energetic action than had been expected ensued. Instead of the cloud piling itself on the electrified surface, it precipitated itself upon it; was condensed by the powerful energy, and crystals instantaneously formed on the sunny side, in spite of its being the warmest.

Now, this power of disturbing the electric condition of glass ought not, upon the principles we have laid down, to be confined to any one of the rays of light in particular; it is a very property of matter, and, therefore, should be enjoyed by them all. This I found, by rigid experiments, to be the case. Admitting homogeneous rays, after passing through a hole in a screen, to fall upon the cloud, crystallization ensued in every case. But some might suppose that this deposition of crystals on the sunny side of a vessel, does not prove that surface to be electrified; it may arise only from some molecular action, taking place during crystallization. That such, however, is not the case, I was satisfied; for a drop of water being passed, on a piece of sponge, into a Torricelian vacuum, very shortly deposited a pearly dew on the sunny side, but no such action took place in darkness.

This deposition of crystals, on the enlightened, and, therefore, warm side of vessels, has long been an unexplained fact; it is noticed chiefly in vessels in which camphor is confined; it now receives an explanation. A piece of camphor being introduced into a Torricellian vacuum, perfectly dark, will not deposit crystals; but, if brought into sunlight, the tube is almost immediately coated with that odoriferous substance, on the enlightened side, and this action proceeds with very remarkable rapidity. Under the pressure of the atmosphere, it takes several days to produce the same effect. In like manner, that mercurial vapour which exists in a torricellian vacuum, deposits a metallic dew on the enlightened side in a short time; but the same result never follows in the darkness. I may remark, that all these depositions take place in direct opposition to what they should do, according to the doctrines of heat, for vapours ought to

condense on cold surfaces, not on warm; whereas, we find they totally disregard that law, and are uniformly deposited on the *nearest* enlightened surface.

But the same experiments which would teach us that such changes as these must, of necessity, take place in the electric equilibrium of the reflecting body, likewise shows that an analogous disturbance is effected in the electric equilibrium of each incident luminous particle; and if we direct our attention to this point, we shall find an extraordinary agreement between theoretical deduction and actual fact. When a particle of light falls upon the surface of a disk of glass, there is, conformably to those laws to which all matter is subject, an electric disturbance upon approximation, or contact. If the velocity with which the particle is moving, be sufficient to enable it to part from the surface by reflection, a change takes place on that reflecting surface, and likewise in the particle of light; that side of the particle which fell on the reflecting surface, becomes electrified, but, owing to its non-conducting power, the opposite side remains in a neutral state. Now, if this particle is received on another glass plate, the first reflection being made horizontally, and the second at right angles to it, or vertically, it is demonstrable that any other particle of light which follows the first, shall be so attracted by it, that a compound motion will ensue, in a resultant, whose path will differ from the true path of reflection; but that, if the second reflection be made horizontally, then no such effect shall ensue: in other words, if a ray of light fall upon a reflecting disk, at a certain angle, and fall again on another disk, so that the last reflection shall operate at right angles to the first, the ray shall become extinct; but if it be in the same plane, then shall the ray be reflected.

When a ray of light falls obliquely upon the plane surface of a transparent substance, it is solicited by certain forces, which draw it out of its former path, and cause it to pursue another, whose direction is entirely determined by the attractive power of the medium. But a certain portion of the ray is found to escape by reflection, and the angle which it makes with the surface of the medium is determined by its former angle of incidence. Now, as the attractive force of the medium acts at right angles to its surface, the effect produced upon the reflected ray is a maximum, when its path is at right angles to the refracted ray. I have formerly shown that these forces, acting at small distances, are of the same nature as capillary action, which may be referred to electricity; and it follows from this, that the greatest elastic disturbance takes place when the path of the reflected ray is at right angles to that of the refracted ray: in other words, under these conditions, light ought to be the more completely polarized, *and it is so.*

From these data, it would be easy to deduce the general laws of polarization of light, from the conditions of a maximum disturbance of the electric equilibrium; as, for instance, Brewster's law, that the index of refraction for any transparent body is the tangent of its angle of polarization. Thus, likewise, we establish the fundamental property of polarized light,—that when a particle of light has fallen

upon a medium, at an angle whose complement is equal to the angle of refraction, it becomes incapable of being reflected from a second surface at the same angle, provided the first reflection is operated horizontally, and the last vertically.

I content myself with having thus pointed out these remarkable coincidences; hereafter I shall consider the action which an interposed sheet of mica, or other crystallized body, has upon light thus electrified. With respect to the phenomena of diffraction, it equally supplies us with interesting results, and furnishes an explanation of the remarkable fact, that when diffraction is performed in homogeneous light, the fringes produced are alternately coloured and dark; coloured, when the differences of the length of their paths are as the numbers 2, 3, 4, 5—dark, when they are as the numbers $1\frac{1}{2}$, $2\frac{1}{2}$, $3\frac{1}{2}$, &c.; a key to the seeming paradox, that two rays of light may be so arranged, that, instead of producing an increased intensity, they shall co-operate, and yet produce darkness.

These experiments likewise lead us to several facts, which, in very delicate researches, may be noticed, though they do not commonly fall under the range of our observation. We may deduce from them that, when a closed vessel, containing air, or other gaseous matter, is exposed to sunshine, the pneumatic equilibrium of it is deranged; it is condensed towards the side which is exposed to the light; if it be a compound, whose parts will not bear compression, without experiencing chemical change, it may so happen that the mere condensation produced by the incident light, is sufficient to produce that change. Hence, a mixture of chlorine and hydrogen gas, exposed to the light, unites with an explosion; and hence it is, that the chloride of hydro-carbon, mixed with chlorine gas, is converted into per chloride of carbon, and muriatic acid is evolved; for the contraction of the glass condenses the mixture, until it gives out sufficient heat to cause combination, 148° Fahr. being sufficient to produce that effect.

Notes of an Observer.

Remarks on Professor Olmsted's Theory of the Meteoric Phenomenon of November 12th, 1833, denominated Shooting Stars, with some Queries towards foming a just Theory. By James P. Espy.

(Continued from p. 92.)

Having thus undermined the theory of the learned Professor, it would be temerity in me, as but few new facts have been brought to light, to propose one of my own; indeed I have none to offer. I have, it is true, incidentally shown some reasons for supposing that these meteors and the aurora borealis have one common origin—but what theory of the aurora, which has ever yet been advanced, will bear the test of a close examination, any better than the Professor's, concerning the meteors? The magnetic influence has been strongly advocated as connected with the aurora, because many auroral arches

have appeared in Great Britain nearly perpendicular to the magnetic meridian, and the streamers parallel to the magnetic dip; but this notion seems to be refuted by the fact, that *some* arches, even in Great Britain, and nearly *all* in this country, have had a very different bearing.

I may, perhaps, without theorizing, be permitted to turn the attention of meteorologists to a few queries on this subject, which I think worthy of further investigation than I have yet been able to give them.

1st. Do auroral arches always move towards some southern point?

2d. Do the streamers always lean in the direction of the motion of the arch?

3d. Is there always a sudden depression or elevation of the dew-point, about the time of a brilliant aurora?

The first two of these queries may be answered in the affirmative, so far as the observations of others have come within my knowledge; and the latter also, so far as my own observations have extended.

4th. Are clouds, or haze, in our latitude, generally formed behind the arch?

If this last query should, by future observations, be answered in the affirmative, it will account for the fact, that the aurora is more frequently seen, here and in England, in the north than in the south; for as the auroral light is always seen above the cloud which is near it, those who are north of the aurora, will be prevented from seeing it by the clouds or haze. Many facts have come within my knowledge which favour this idea.

I have frequently seen clouds accompanied with auroral light, pass from the north to south, and from west to east, with the light always above and in advance of the cloud, so that when the cloud had passed the zenith twenty or thirty degrees, it seemed to hide the light from view. One of the most remarkable instances of this kind occurred on the 17th of May, 1833. About nine o'clock, a brilliant aurora appeared low in the north. A few minutes after nine, beautiful streamers (not in motion) appeared rising into a clear sky, from a dense light below, which seemed to rest on dark clouds near the horizon. I watched it till within a few minutes of ten, and then, while I was taking notes, a bright arch was completely formed; and when I looked out again at ten, it was almost exactly in the zenith, for its southern edge was very near Alpha Lyræ, and it reached entirely across the heavens, in a direction about twenty degrees south of east, and as many north of west. It moved pretty rapidly to the south, and disappeared at twenty minutes past ten, about eleven degrees south of Lyra. *During the whole time of my observation, clouds were constantly forming in the northern part of the heavens, so rapidly as to keep pace with the motion of the arch; all north of the arch being cloudy, and all south of the arch being clear;* and when the arch disappeared, it did so as if it was by the intervention of the clouds. The arch was about three degrees broad in the zenith, and certainly not more than a quarter of a degree near the horizon, and in the zenith the light was much less dense—it was a little bent at both ends, and had there something of the appearance of a ribbon, with its edge a little turned

towards the observer. The wind had been north in the morning, and changed round to the south-west below during the day; but there is reason to believe that an upper (not the uppermost) current was still coming from the north—the cloud certainly moved or *formed* in that direction, and I have frequently known a northern current above to continue to blow after the wind below had changed round even to the south. This arch was not seen at Wilmington, twenty-eight miles south-west of Philadelphia, though the aurora was.

Having mentioned the probability in this case, of an upper current of air from the north, I will propose here another query.

5th. Are there always two currents in different directions, at the time of aurora, and is the upper one generally from the north? Or where the upper and lower currents are in the same direction, from the north, does the upper move fastest?

There are several facts which lead me to suppose that this question may, by further observation, be answered in the affirmative. First, auroras generally commence low, and rise gradually to a higher elevation, which may as naturally be supposed to depend on a horizontal motion towards the south, as on a perpendicular motion upwards;—the same may be said of auroral arches, which most probably travel horizontally. Again, in many cases which have come under my own observation, these currents have been detected.

Besides, many meteorological phenomena can easily be accounted for, on the supposition of an upper current of air from the north, at the time of their occurrence, even when this current is not indicated by clouds.

I have known many instances, some when clouds were visible in the upper current from the north, and some when they were not visible, when the dew-point sunk to thirty-three and thirty-four degrees below the temperature of the air, and in one case to forty-one below. In most of these cases it was discovered by a sudden depression of temperature, (amounting, in one case, to 14° in an hour, with a change of wind to north, which occurred very soon after this great depression of dew-point,) that there had been a north current above, probably not many hundred yards from the surface of the earth, at the time of this depression.

The cause of these great depressions of the dew-point will readily appear, from what will be said hereafter of downward vortices, from the overlapping cold dry current. A small quantity of this cold dry air may, on descending, spread over a considerable surface of land, and thus coming in contact with warm ground, its temperature may soon be much increased, while its dew-point will continue low. It may be added, that the sudden fluctuations of the dew-point about these lines, favour this explanation.

Several phenomena also, which occurred on the thirteenth of November, and the day before, can be accounted for on the supposition that there was a cold north-west current above at that time. The dew point at one o'clock on the twelfth, was 57° Fahr., and at six in the evening, it was 40°. It rained a little during the day, the wind being south-west, but it was perfectly clear in the evening. Having seen many instances of so sudden a change, particularly a

depression of the dew-point, being succeeded by an aurora, I looked out for one that evening, but neither aurora nor shooting stars were visible as late as ten o'clock. There were no clouds in the upper stratum of air visible on the twelfth, but on the eleventh, the lower air was from the east, and the upper from the west, with rain, the dew-point being 37°. These fluctuations being so great and so sudden, I was not a little disappointed at finding not even the slightest appearance of an aurora.

Again, on the supposition of a cold current above, it is very easy to account for the sudden and violent gusts which occurred on the twelfth, and the night of the thirteenth of November. On the twelfth there was a gust in the Hudson, which upset a vessel, in which all hands were lost. On the morning of the thirteenth, there were several gusts of wind at New Haven, attended with an increase of meteors; and about eighty miles below Philadelphia, on the morning of the twelfth, about seven o'clock, so violent a wind blew directly from a cloud unusually round and well-defined, quite low, and apparently not more than *two hundred yards long*, that the Captain of the vessel was afraid the ship would drag her anchors. From this cloud, as was mentioned before, darted streaks of light similar to the aurora. Captain Parker also, in the Gulf of Mexico, had the wind blowing directly from the cloud in the north-east, round which the meteors were playing. It was stated before, that the equilibrium of the atmosphere in its ordinary state, is stable, because the upper strata of air certainly contains as much caloric as the lower, pound for pound—and probably a little more; but if we suppose a very cold current from the north-west to overlap a warm current from some southern point, to a great distance, or if we suppose the upper current from the north, to move much faster than the lower to the south, we may easily perceive that in this extreme case, the equilibrium becomes unstable, and many vortices may be formed, (of no great breadth,) of the cold air coming down from above, and of course making a violent current at the surface of the earth, in all directions outwards from the centre of the vortex, and consequently from the cloud, if one should be formed there. That a cloud should be formed there, in many instances, is highly probable; because the vapour surrounding the vortex would be mixed with the cold air of the vortex, and if there should be more than enough to saturate the compound, it would be condensed into a cloud. I acknowledge that in the case of the cloud seen down the Delaware, I have no proof that, to the west of that cloud, the wind blew from the east; but it is very certain that that cloud was very near to the observer, otherwise it would have been seen at Philadelphia; but it was not; neither was there any strong wind at Philadelphia at that time, nor so late as half-past ten o'clock. After that period I cannot speak from my own knowledge.

Now, if we suppose an upper current of very cold air, from the north-west or west, overlapping one of considerable warmth at that time, (and at Philadelphia the air at the surface of the earth, on the twelfth was actually seventeen degrees warmer than on the eleventh, and twenty-one degrees warmer than on the thirteenth,) it will most

satisfactorily account for these several phenomena—the sudden fall of the dew-point seventeen degrees on the afternoon of the twelfth—its fall of sixteen degrees more on the night of the twelfth—the sudden blasts which occurred at that time, caused by the downward vortices—the formation of a cloud in some instances, at the borders of a vortex, where the vapour in the surrounding atmosphere was sufficient in quantity to supersaturate the cold descending air, and the wind blowing from the vortex must necessarily blow from the cloud—the great change of temperature which occurred just before and just after—and, as the meteors have been demonstrated to be of atmospheric origin, and not gravitating bodies, perhaps I may be permitted to add, that the supposition of an upper very cold current, then existing, from the west or north-west, from which, in various places, vortices of small diameter might descend, will not only account for the gusts of wind observed by Mr Palmer, but also throw some faint light on the fact mentioned by him, that immediately after these blasts, the *number of meteors was increased*—for if the fifth query should, by further observation, be answered in the affirmative, it will then be rendered highly probable that the aurora is electrical, and depends on the overlapping of two currents of air of different electrical tensions, and consequently any thing which might bring these two currents into nearer proximity, such as the vortices spoken of above, would probably increase the development of electricity.

Nor is this probability very faint, when it is considered that almost all the clouds we hear of that night, were accompanied with a brilliant display of meteors, or auroral light, and some of them were highly luminous, as if the particles of condensed vapour of which they were composed, formed an interrupted conductor of electricity from one stratum to another, causing the electricity to appear in passing from one particle to another. And even when a cloud was not formed by one of these descending vortices, the vapour in the surrounding air not being enough to supersaturate it, yet the quantity of vapour in it must have increased by the proximity of the surrounding air of a higher dew-point, and thus its power of discharging its electricity would be increased. It need hardly be mentioned, that moist air is a better conductor than dry air.

I am well aware that these hypothetical speculations have but little weight with the true inductive philosopher. He inquires, is it a *fact* that there was an upper current on the night of the twelfth of November, from the north-west, overlapping a warmer current below—and by warmer here I mean containing more caloric to the pound—and has there never been an upper current of cold air overlapping an under one of warm air, since the Bonpland meteors of 1799?

I answer, I do not expect him to place more confidence in these speculations than I do myself, indeed not so much; for I have seen so many instances of the dew-point falling in consequence of an upper current from some northern point, of which many were accompanied with an aurora here, and many others with an aurora elsewhere, that

I confess I incline to the opinion that these two things are connected together as cause and effect.

But as to others, all I hope or expect by these speculations is to excite interest enough to induce them to observe *whether these things are so.* For this purpose, I will mention a few of the many cases in which I have observed the dew-point to fall immediately before and after the occurrence of an aurora. On the 8th of March, 1834, at half-past five o'clock in the afternoon, the dew-point was $59\frac{1}{2}°$ Fahr., and at six o'clock, a shower having intervened, it had sunk fourteen degrees, and was then clear.

This was one of the most sudden falls I had ever seen, and I looked out with considerable anxiety for an aurora, and was a good deal disappointed at not being able, during the whole evening, to detect even the least appearance of one. Next morning, at sunrise, the dew-point was 15° above zero, having sunk $44\frac{3}{4}°$ in $13\frac{1}{2}$ hours. The circumstance of no aurora being seen here, when there had been so remarkable a fall of the dew-point, shook my faith in the hypothesis; but it was strengthened again by discovering that the tail of Mr. Olmsted's comet had been seen on that night with uncommon brilliancy, by the Professor himself, at New Haven. He says: "This evening, the sky having been thoroughly cleared by a copious shower of rain, the luminous cone, or lens, reached nearly to the pleiades, through about 60° of long., and was visible till near nine o'clock." Again, from the afternoon of the 29th of March, 1834, to the morning of the 30th, the dew-point sunk from $47\frac{1}{2}$ to $9\frac{1}{2}$, and though it was clear in Philadelphia on both these nights, and the aurora anxiously expected, none occurred.

But here again the comet, or zodiacal light, of Mr. Olmsted, comes to our aid, and will not allow us yet to abandon our hypothesis. For he says: "On the 30th, it reached in a direct line from the sun between the pleiades on the west, and Aldebaran on the east, having its apex a little west of the latter, and making an angle with the ecliptic of seven and a half degrees, which is the inclination of the sun's equator, as has been observed heretofore respecting the zodiacal light."

Now, it is not a little remarkable, that immediately after this repeated appearance at New Haven, it begins to appear at Philadelphia, and as the Professor will be gratified to learn that the tail of his comet was seen beyond the neighbourhood of New Haven, I will for his gratification, as well as to show the existence of various currents, and rapid fluctuations of the dew-point, about that time, quote, verbatim, the words of my journal written at the time.

"On the 31st of March, during the whole day, there was a strong wind from the south-west. Notwithstanding the temperature did not rise above forty degrees, and the dew-point at one o'clock, was thirteen, having fallen from sixteen during the morning, the upper clouds were coming from the south-west as usual, the middle from the west all day, and in the afternoon at five o'clock, a lower stratum of clouds came up from the northern horizon, hiding from view in the north, the upper clouds of both strata, while, at the same time, the wind at the surface of the earth increased in strength from the

south-west. This lower current continued to blow till some time between eight and twelve on the second of April, when it changed to the north. In the mean time, the dew-point had gradually risen until the morning of the second, at eight o'clock, it was $56\frac{1}{2}°$, some rain having fallen both on the first and second. All this time the middle current of clouds came from the west. On the afternoon of the second it began to fall, and in the evening, as soon as it was dark, an aurora was visible in the north-west, reaching from Orion's belt nearly to the northern horizon, at first not rising so high as the pleiades; but about nine o'clock, the pleiades were in the brightest part. At the same time there was a very faint aurora nearly in the east, its central part reaching as high as Spica Virginis."

The next morning, third of April, the dew-point had fallen to 24°, that is, 32° in twenty-four hours. During all this day, the air below came from the north, the middle from the west, and the upper from the south. As soon as dark, this evening also, the aurora appeared in the north-west, occupying the same place as on the preceding evening. It, however, rose higher in the latter part of the evening, and a few minutes before nine o'clock, it assumed exactly the appearance of the aurora described by Professor Bache, in the Journal of the Franklin Institute, vol. xiii., p. 1, with this only exception, that the pillars were not so straight and smooth, and they rested on a pretty dark cloud, which sloped downwards towards the horizon, which it reached exactly under Orion's belt. This cloud was much narrower at its northern end, where it was about 15° high, and under it was a dull auroral light, down to the very horizon. These pillars continued to rise nearly at right angles to a pretty strong north wind.

On the next day, the fourth, the wind was north-east, no change having taken place in the upper currents, and on the fifth, the wind continued very strong from the north-east, the upper current being from the south-west, and the middle veering from the west to the south. This night also, the aurora was seen between ten and eleven in the north-west; and the dew-point, although it had risen the preceding evening with the upper south wind, was down again on the morning of the sixth, to 15°.

I have not yet been informed whether these auroras were seen at New Haven, but Dr. Gibbons, of Wilmington, Delaware, who has watched the aurora very minutely for several years, says, in his Meteorological Journal, published in the Advocate of Science, that the aurora was not seen on any of these nights, nor indeed on any night of March, April, May or June. The inference here again appears to me inevitable, that these auroras could not be three or even two miles high;—how much lower we know not. Indeed, I find, by comparing Dr. Gibbons' Journal with mine, that of fifteen auroras which were seen at Wilmington, from the 10th of July, 1831, till the 15th of December, 1833, only two were seen at Philadelphia. In all these cases there is marked in my journal a sudden and unusually great change in the dew-point: twelve of them falls, and three rises. Of the three auroras corresponding to the three rises, one was the 17th of May, 1833, which was seen at Philadelphia, as a beautiful arch passing the zenith, at ten o'clock.

The dates of all these auroras should be mentioned here, but this paper has already been extended beyond the limits originally intended; and I must content myself with mentioning a few dates when there was a remarkable change of the dew-point here, but no aurora, in the hope that some persons who keep a meteorological journal to the north of this, may have the curiosity to examine whether an aurora occurred at any of those times or not, and publish the result of their examination, whether it shall be in the negative or affirmative. At all events, the comparison of these accounts, if published, will be highly interesting, and cannot fail to aid in the formation of a just theory in explanation of this meteor.

In 1832. January 26th; February 21st and 24th; March 14th, 18th and 27th; April 20th or 21st; May 21st and 27th; August 25th; September 5th and 23d; October 16th, 24th and 26th; November 14th and 20th; December 19th or 20th.

In 1833. January 11th or 12th, 16th and 26th; February 7th and 25th; March 2d; July 31st; August 8th; October 3d and 11th.

In 1834. January 3d or 4th, 13th and 21st; February 12th and 26th; March 3d, 8th, 21st or 22d, and 30th; April 11th and 27th; June 2d or 3d, 11th or 12th, and 27th; July 11th; November 16th.

At all these times there was a remarkable *depression* of the dew-point; but I have not had it in my power to ascertain whether the aurora was seen or not at distant places on these nights;—it was not seen at Philadelphia. It may be mentioned too, that in case the aurora was seen about these times, it was probably seen a little before them, in places north of Philadelphia; for I observe that when the aurora was seen about the same time at New Haven and at Philadelphia, it occurred a day or two sooner at New Haven than at Philadelphia, and that in like manner, it occurred sooner in one instance at Philadelphia than at Wilmington, Del.

This probability is increased from the fact, that the aurora, and especially auroral arches, are known generally to travel towards the south.

As there are no facts in opposition to the suggestions here made, and some, though not enough to found a theory upon, in favour of them, I am sure that even the rigid inductive philosopher will excuse me for throwing out these hints as worthy of further investigation.

(*To be continued.*)

Remarks upon the Employment of Pressure Engines, as a substitute for Water Wheels. *By* Daniel Livermore, *Civil Engineer.*

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

The committee of the Institute have, by their accurate and valuable experiments, afforded the most satisfactory evidence that, under peculiarly favourable circumstances, water wheels may be so constructed and used as to ensure an *effective* application of three-fourths of the power applied for their propulsion; and from this, some me-

chanics have inferred that the present modes of applying water power admit of little or no improvement.

A more comprehensive view of the subject will, in the opinion of the writer, lead to a different conclusion. The following remarks are, therefore, offered in illustration of the probable advantages of substituting pressure engines for water wheels, in the propulsion of machinery, under various circumstances.

Before entering upon this subject, it may be proper to premise that the location of water power is generally such as to afford only a moderate amount of head and fall; and it may be assumed with tolerable certainty, that more than nine-tenths of the water power in the United States is confined to situations which do not afford an aggregate of ten feet, head and fall.

It is well known that, by the present modes of application, the *proportion* of power rendered effective is much less, with a moderate amount of head and fall, than in situations where the elevation is sufficient to admit the application to large overshot wheels, or other wheels, on which its action is continuous, by weight, or steady pressure, instead of the sudden effort of impact, whether derived from *direct* percussion, or by reaction; in the latter case, the greatest *effective force* found by actual experiment does not, as I am informed, exceed one-third of the power applied.

To simplify the subject, suppose, in *every* case, ten feet head and fall can be obtained for use. Then we will first consider it as applied to a pitch back, or breast wheel, both of which act upon the same *principle*, and are justly considered the most effective wheels for this amount of head and fall; yet, to prevent obstruction from flood water setting up the tail-race, it is generally expedient to leave $2\frac{1}{2}$ feet of fall, equal to one-fourth of the power, unappropriated. The remaining $7\frac{1}{2}$ feet head and fall, equal to seventy-five per cent. of the power, is further reduced by percussive action of the water at its introduction on the wheel; by its premature escape from the buckets; its retrograde action at its final delivery therefrom, and the retarding effects of centrifugal force, during its action on the wheel; so that not more than sixty per cent. of the power, *as applied*, is effective; or, taking into consideration the fall unappropriated, the *effective* force is only forty-five per cent. of the power.

2dly. If the water be applied to the best constructed reacting wheels, no loss is sustained by flood water, so long as the rise of water in the fore-bay is in the same proportion as in the tail-race; and the whole column may, in all cases, be brought to act, *in effect*, by percussion, and thus produce an effective application of force equal to one-third, or thirty-three per cent. of the actual power.

3dly. Undershot and tub-wheels are subject to obstruction by flood water, and if we leave $2\frac{1}{2}$ feet of fall unappropriated, there remains seventy-five per cent. of the power, which is applied percussively, and thus produces an effective application equal to twenty-five per cent. of the actual force.

4thly. Flutter wheels, of the description used for saw mills, are peculiarly liable to obstruction from back water, and it is generally

necessary to leave $2\frac{1}{2}$ feet fall, or one-fourth of the power, unappropriated, and the loss from percussive application of the remainder would reduce it to twenty-five per cent.; furthermore, at least one-third of the water escapes from these wheels without *any beneficial* action, leaving only about seventeen per cent. of effective force.

If we allow only one foot unappropriated fall, the calculations would give, for five feet head and fall, the same *proportional* results for the *effective force*, as before shown; but the *practical* result would be the stoppage of every wheel, except the reacting wheel, whenever there happened to be a superabundance of water.

In the application of water for the propulsion of pressure engines, the *whole column* acts by *weight*, or *pressure*, and the force is not diminished by flood water, so long as the rise at the outlet, or tail-race, does not exceed that in the fore-bay.

Pressure engines may likewise be constructed for use in situations where there is but a small quantity of water, and a greater amount of head and fall than can be applied to any single wheel; in such situations, these engines have been applied in Europe.

The engine which I have patented, under the denomination of the "Regulated Pressure Engine," is materially different in its construction, and adapted to situations affording but *small amount of head and fall;* this engine affords the means of adjusting the intensity of the force excited in either direction, so as to meet the resistance to be overcome principally in one direction, if required; or it may be equalized, and applied to produce a rotary motion, in like manner as is adopted for the steam engine.

This engine has the advantage over other pressure engines, in point of simplicity, and economy of construction,—affords more ample water way through the valves,—and so perfectly obviates the defect heretofore experienced from the non-elastic action of water, that, in a recently constructed working model, not the least concussion was observable from the action of the water, which was applied with between four and five feet head.

It must, however, be admitted, that this engine labours under the disadvantage attending all new machines on their *first* introduction, viz: the mechanical execution, in many of the minor details, will lack that accuracy of finish, and that due adjustment of the component parts, which are easily effected in the construction of machines to which thousands of ingenious mechanics have served a regular apprenticeship, and to the due execution of which they have for years devoted their whole attention. A full development of the advantages to be derived from the use of such engines, could not, therefore, be reasonably expected in their *first* construction. The first working model of this description being furnished with a piston six inches square, attached to a working beam, propelled a pump, having a plunger four inches square, with the same length of stroke as the engine, and so applied as to raise water from the outlet, or tail-race, into the fore-bay. Thus, if we make no allowance for leakage, the *effect* was equal to $\frac{16}{36}$, or a little more than forty-four per cent. of the force applied, and in this case the full force of the engine was not

excited; and, from the best calculation we could make, the *unexcited* force would exceed the most liberal allowance for loss from leakage, so as to leave the effect fully equal to forty-four per cent., after allowing for leakage and friction.

The head and fall applied to the breast wheels used at the Fairmount Water Works, as appears by a report of the Watering Committee in 1823, is eight feet six inches; and forty gallons, acting on the wheels, raise (after allowing for leakage) one gallon to the height of 96 feet: here the effect is $1 \times 96 = 96$; and the power, $40 \times 8\frac{1}{2} = 340$

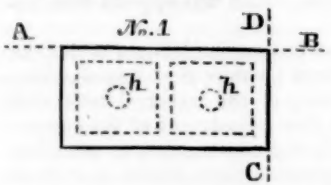
Thus, the *effect*, independent of leakage and friction, would but little exceed twenty-eight per cent. of the power, although applied to machinery exhibiting, in every part, evidence of consummate skill, and accuracy of workmanship.

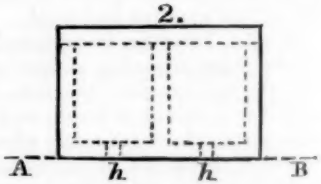
Blairsville, Indiana county, Pa., Jan 1st, 1835.

Notice of Hollow Bricks, used for the Construction of Arches.

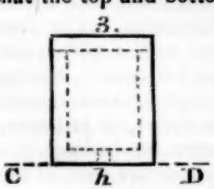
TO THE COMMITTEE ON PUBLICATIONS.

Gentlemen,—During a recent visit to Europe, I saw, at Toulon, buildings, the roofs of which were made fire proof, by the use of *hollow bricks*, making an arch so light as to be supported by walls of moderate thickness. I have not the means of giving exact information as to the dimensions of the bricks used by the French engineers, or the thickness of the walls by which the arches are sustained; but I think I can give a general notion of the manner of making these bricks, which will enable an architect to apply them, after a few trials, to any building to which they may be adapted: and I would particularly recommend the subject to the attention of the architect of the Girard College.





The form of the brick being that of a voussoir of an arch, except that the top and bottom are both made flat, suppose the dimensions of the upper surface to be ten inches by five inches, and the depth six inches, the radius of the arch twenty feet; agreeably to which supposition the subjoined drawings are made, allowing half an inch for the thickness of the material. Of the cuts, No. 1 is a plan of the brick, No. 2 an elevation on the line A B of the plan, and No. 3 an elevation on C D.



The mould will consist of a box, fitting the exterior shape, into which is pressed a former, having solid parts corresponding to those which are to be hollow in the brick; in this manner, the brick is formed without the top, which is made separately, and applied whilst wet; a hole (*h*) about three-fourths of an inch or an inch in diameter, punched in the bottom of each compartment, facilitates the drying and burning, prevents explosion by the expansion of the contained acid, and gives a better hold to the mortar in plastering on the arch, if necessary.

The quantity of material in a brick of the above dimensions, will be about 130 cubic inches, or less than half of that (296 cubic inches) in a solid one of the same dimensions; but it is probable that the weight of the bricks cannot be diminished in that proportion, because I apprehend that the dimensions given above are greater than it would be found advisable to use in practice.

Jan. 25th, 1835.

Facts in reference to the Spark, &c. from a long conductor uniting the poles of a Galvanic Battery. By Joseph Henry, *Professor of Natural Philosophy in the College of New Jersey, Princeton.*

TO THE COMMITTEE ON PUBLICATIONS.

Gentlemen,—The American Philosophical Society, at their last stated meeting, authorized the publication of the following abstract of a verbal communication made to the Society, by Professor Henry, on the sixteenth of January last. A memoir on this subject has been since submitted to the Society, containing an extension of the subject, the primary fact in relation to which was observed by Professor Henry as early as 1832, and announced by him in the American Journal of Science. Mr. Faraday having recently entered upon a similar train of observations, the immediate publication of the accompanying is important, that the prior claims of our fellow countryman may not be overlooked.

Very respectfully yours,

A. D. Bache,
One of the Secretaries Am. Philos. Soc.

Philadelphia, Feb. 7th, 1835.

Extract from the proceedings of the stated meeting of the American Philosophical Society, January 16, 1835.

The following facts in reference to the spark, shock, &c., from a galvanic battery, when the poles are united by a long conductor, were communicated by Professor Joseph Henry, and those relating to the spark were illustrated experimentally.

1. A long wire gives a more intense spark than a short one. There is, however, a length beyond which the effect is not increased; a wire of 120 feet gave about the same intensity of spark as one of 240 feet.

2. A thick wire gives a larger spark than a smaller one of the same length.

3. A wire coiled into a helix, gives a more vivid spark than the same wire when uncoiled.

4. A ribbon of copper, coiled into a flat spiral, gives a more intense spark than any other arrangement yet tried.

5. The effect is increased, by using a longer and wider ribbon, to an extent not yet determined. The greatest effect has been produced by a coil 96 feet long, and weighing 15 lbs.; a larger conductor has not been received.

6. A ribbon of copper, first doubled into two strands, and then coiled into a flat spiral, gives no spark, or a very feeble one.

7. Large copper handles, soldered to the ends of the coil of 96 feet, and these grasped by both, one by each hand, a shock is felt at the elbows, when the contact is broken in a battery with one and a half feet of zinc surface.

8. A shock is also felt when the copper of the battery is grasped with one hand, and one of the handles with the other; the intensity, however, is not as great as in the last case. This method of receiving the shock may be called the direct method, the other the lateral one.

9. The decomposition of a liquid is effected by the use of the coil from a single pair, by intermitting the current, and introducing a pair of decomposing wires.

10. A mixture of oxygen and hydrogen is also exploded by using the coil, and breaking the contact, in a bladder containing the mixture.

11. The property of producing an intense spark is induced, on a short wire, by introducing, at any point of a compound galvanic current, a large flat spiral.

12. A spark is produced when the plates of a single battery are separated by a foot or more of diluted acid.

13. Little or no increase in the effect is produced by inserting a piece of soft iron into the centre of a flat spiral.

14. The effect produced by an electro-magnetic magnet, in giving the shock, is due principally to the coiling of the long wire which surrounds the soft iron.

FRANKLIN INSTITUTE.

Annual Meeting.

The annual meeting of the Institute was held at their Hall, on Thursday evening, Jan. 15, 1835.

James Ronaldson, President, in the chair:

Robert Lindsay, Recording Secretary, P. T.

The minutes of the last quarterly meeting were read and approved.

Donations of books were received from The Royal Institution of

London, The Royal Society of London, The Zoological Society of London, Wm. Carpmeal, Esq., of London, C. W. Pasley, C. B., Col. of Royal Engineers, London, The American Institute of the city of New York, and from Messrs. S. V. Merrick, L. Johnson, Adam Ramage, and S. C. Atkinson, of Philadelphia.

From Mr. Franklin Peale—A specimen of medal ruling, done in Paris.

From Mr. John Sartain—A mezzotint engraving of Wm. Penn.

From Messrs. E. & T. Fairbanks, of St. Johnsbury Plain, Vt.—A weighing machine.

From Mr. Richard Oakford—Specimens of copper ore, from South America.

The actuary laid on the tables the various periodicals received in exchange for the Journal of the Institute, during the last quarter.

Prof. Bache, from the Board of Managers, read their eleventh annual report, which was accepted, and referred, for publication, to the Committee on Publications.

The treasurer presented his reports for the last quarter, and for the year, which were read and accepted.

The chairman of the Committee on Science and the Arts, presented a report of the transactions of the committee during the past year, which had been drawn up by direction of the committee. The report having been read, was, on motion, referred to the Committee on Publications, for insertion in the Journal of the Institute.

On motion, the following resolutions were unanimously adopted:

Resolved, That a special vote of thanks from the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, be transmitted, by the Corresponding Secretary, to Henry Beaufoy, Esq., of London, for the valuable donation made to them of the nautical and hydraulic experiments, &c., by his late father, Col. Mark Beaufoy.

Resolved, That Mr. Beaufoy, by the publication of this work, has raised to the memory of his father, a monument which must transmit his name with honour to posterity.

The tellers reported the result of the annual election for officers and managers for the ensuing year, from which it appeared that the following gentlemen were duly elected, viz:

James Ronaldson, *President.*

Isaiah Lukens, }
Thomas Fletcher, } *Vice Presidents.*

John C. Trautwine, *Rec. Secretary.*

Isaac Hays, M. D., *Corr. Secretary.*

Frederick Fraley, *Treasurer.*

Managers.

Samuel V. Merrick,	J. Henry Bulkley,
Abraham Miller,	John Wiegand,
William H. Keating,	John Agnew,
Isaac B. Garrigues,	W. B. Reed,
Rufus Tyler,	George Fox,
John Struthers,	Alexander M'Clurg,
Matthias W. Baldwin,	Robert Lindsay,
Mordecai D. Lewis,	Joseph S. Walter, Jr.
Charles H. White,	Samuel Hufty,
Benjamin Reeves,	*John C. Cresson,
Alex. Dallas Bache,	*Charles Wetherill.
Alexander Ferguson,	

* New members.

Extract from the minutes.

JAMES RONALDSON, *President.*

ROBERT LINDSAY, *Rec. Sec. P. T.*

Minutes of the Board of Managers.

At a meeting of the Board of Managers, held at the Hall of the Institute, January 22, 1835,

GEORGE FOX, Esq., was elected Chairman of the Board; and Messrs. MATTHIAS W. BALDWIN, and FREDERICK FRALEY, Curators for the ensuing year.

And at a meeting of the Board, held January 28th, the chairman nominated the standing committees, agreeably to the by-laws. On motion, GEORGE FOX, Esq., was added to the committee on the library, and Mr. JACOB PEARCE, and Prof. HENRY D. ROGERS, to the committee on the cabinet of minerals; when the committees were appointed, as follows:

On the Library.

Mordecai D. Lewis,	William B. Reed,
Isaac Hays, M. D.	Robert Lindsay,
J. Henry Bulkley,	Charles Wetherill.

On the Cabinet of Models.

John Agnew,	Joseph S. Walter, Jr.
John Struthers,	John C. Cresson,
Charles H. White,	Charles Wetherill.

On the Cabinet of Minerals.

Isaiah Lukens,	Samuel Hufty,
Abraham Miller,	Jacob Pearce,
William H. Keating,	Henry D. Rogers.
John C. Trautwine,	

On Publications.

Alex. Dallas Bache, Matthias W. Baldwin,
Samuel V. Merrick, Rufus Tyler,
Isaac Hays, M. D. John C. Trautwine.

On Premiums and Exhibitions.

Samuel V. Merrick, Isaac B. Garrigues,
Joshua G. Harker, Alexander M'Clurg,
William H. Keating, Alexander Ferguson,
Frederick Fraley, John C. Cresson.

On Instruction.

Frederick Fraley, John Wiegand,
Matthias W. Baldwin, John C. Trautwine.
Rufus Tyler,

On the Monthly Meetings of the Institute.

Samuel V. Merrick, Matthias W. Baldwin,
Alex. Dallas Bache, Benjamin Reeves,
Rufus Tyler, John C. Cresson.

Managers of the Sinking Fund.

Samuel V. Merrick, Alexander Ferguson.
Frederick Fraley,

Auditors.

Isaac B. Garrigues, Joshua G. Harker.

Extract from the minutes.

George Fox, *Chairman.*

William Hamilton, *Actuary.*

Annual Report of the Board of Managers.

The Board of Managers respectfully present to the Institute, their eleventh annual report.

The department of Instruction has been continued with the organization which was reported last year, with some modifications in its details, from which a beneficial influence is confidently anticipated. The Chemical instruction is still carried on by Prof. Mitchell, and the course now in progress is marked by that devotion to the interests of the institution, which has heretofore elicited the warm acknowledgments of the Board of Managers. The course will embrace many of the applications of chemistry to the arts, and be illustrated by suitable models, prepared under the direction, and at the expense, of our zealous teacher of chemistry.

The course of Natural Philosophy, under the charge of Prof. Johnson, is presenting to the class some of the most striking applications of physics, and is prosecuted with that assiduity which marks his character.

The evenings allotted to volunteer lectures have hitherto been

filled by Prof. H. D. Rogers, and J. P. Espy, Esq., who, in treating the branches of natural science to which they are devoted, are enlarging the boundaries of knowledge, and contributing to the best interests of the members of this institution.

The Drawing School is still under the charge of Mr. William Mason, with whom Mr. John M'Clure has been associated, as teacher of practical mechanical drawing; the united efforts of these gentlemen have placed the school in the first rank. The Board have in contemplation a plan by which the acquisitions in this school may be made to aid the model room, by requesting each pupil to deposit a drawing of some machine, or of mechanical tools and implements. By this means, useful emulation will be excited, and a valuable collection of proper objects of study be prepared for the use of young mechanics.

The English Evening School is continued by Mr. Seth Smith, whose indefatigable services the Board again acknowledge. Although this school has met with more favour than in previous years, it is far from enjoying that portion of public patronage to which it is entitled.

The Library is gradually increasing, two hundred and forty-six volumes having been added during the past year. Of these, thirty-two have been acquired by donation, forty-five by exchange of the Journal of the Institute, and one hundred and sixty-nine by purchase. The reading room has been numerously attended, and the books and periodicals forming the permanent and circulating portions of the library, are in constant use by many of our enterprising and industrious members. It is a subject of deep regret to the Board, that a more liberal appropriation to this department of the institution has not been within their power; but they console themselves with the reflection, that, like the other objects of the Institute, it is steadily and surely gaining in usefulness and strength. The collections of models and minerals are also gradually acquiring importance and system, and the models of new machines which will come into our possession by the administration of the Scott's legacy premiums, cannot fail to prove useful in an establishment pre-eminently devoted to the mechanic arts.

In compliance with a long cherished opinion of some of our most valuable members, who have believed that biennial exhibitions of the products of American industry would be found more advantageous to the manufacturer and mechanic than those held annually, no public exhibition has been held this year; but the monthly conversation meetings have furnished occasion for the display of such new inventions and improvements in existing manufactures, as the inventors, or makers, were desirous to present to public notice and examination. It is intended to hold an exhibition of domestic manufactures, under the auspices of the Institute, at the usual time, next autumn, and early measures will be taken to give public notice of this intention.

The Committee on Science and the Arts, constituted at the commencement of the year just past, now consists of sixty members, of whom seldom less than twenty are in attendance upon its meetings.

The combination of theoretical knowledge and practical acquirement in this committee, render it of important service to inventors, and this happy union may be confidently expected to aid the science and the arts of our country, by promoting investigations in their several branches. The committee have examined, by sub-committees, fifty different inventions, or subjects, which have been brought before them during the past year. In some cases, acting as counsellors to inventors, the results of their labours, though useful, are unseen by the public; in other cases, their reports, published in the Journal of the Institute, attest their activity. A portion of the subjects undertaken through the year, have not yet been examined to completion. The Board again call the attention of the ingenious, throughout the United States, to the existence of the Scott's legacy fund, from which premiums are due to the authors of useful inventions, or improvements, and which, under the direction of the committee just referred to, may be expected to be distributed, as desired by the testator, and by our city, impartially, and without unnecessary fastidiousness.

Intimately connected with the prosperity of mechanical science in our country, must be considered the support of a journal devoted to its best interests; and the members of the Institute, especially, should feel it their duty to promote the circulation of the Journal published under the auspices of the institution: in doing this, they may well feel a pride in the character and standing attained by this journal—a standing which cannot fail to elevate that of the mechanic arts, and of mechanics, in our country. The members should not lose sight of the fact that amusement is so frequently preferred to instruction, that the circulation of such a periodical requires effort on the part of the friends of true science.

Delays incident to the nature of one of the subjects of investigation undertaken by the committee, on the explosions of steam boilers, have hitherto prevented the completion of their report. These experiments, namely, on the strength of the materials used for steam boilers, are understood to be nearly, if not quite, completed, and it is hoped that their results will be communicated to the general committee, for the Institute, as soon as the other avocations of the members of the sub-committee may permit.

The experiments on water wheels have been already made public, and have gained for the Institute a meed of praise, which has been more unhesitatingly bestowed abroad than at home. The committee having charge of this subject have yet a portion of their labours to complete, and the Institute has a right to expect that their zeal will not be allowed to flag at the time when so much depends upon its exercise.

Since the last annual report, the Institute has received an increase of 157 members. Seven members have enrolled themselves as life subscribers, seventy-seven have resigned their memberships, and fifteen have died, leaving the present number of members 1724. The very moderate sum of three dollars per annum received from such as are not members for life, furnishes the entire reve-

nue by which the active energies of the Institute are sustained, the proceeds of the Journal being devoted exclusively to its improvement and support, and the other items of receipt being appropriated to the extinguishment of the debt contracted by the erection of the hall. The institution has been in operation upwards of ten years, and, during this period, has had to struggle with all those difficulties which mark the progress of most scientific undertakings; but, being formed on the basis of public utility, it has gradually risen superior to those difficulties, and has attained a height which must be most gratifying to its founders. The full development of its plan has removed opposition, and produced, in the public mind, a proper appreciation of its merits; and the rapid advance which it has made within the last four years is mainly to be attributed to the facilities which it presents for the acquisition of useful knowledge, at a price within the reach of almost every member of the community.

The accommodations afforded by the present lecture room, have been proved, by the experience of two years, to be too limited, and it should be an objeet of primary importance with our successors, to take this matter into consideration. Although every other department of the institution sheds a beneficial influence on the character of the mechanics who are attached to it, the lecture room is the great school in which the objects of our association are to be carried out; and the future growth of the Institution must greatly depend on the increase of the accommodations which are there furnished.

Submitted by order of the Board of Managers.

(Signed,) ALEX. FERGUSON, *Chairman.*

WILLIAM HAMILTON, *Actuary.*

Annual Report of the Committee on Science and the Arts.

In pursuance of the directions of the Committee on Science and the Arts, the following report of their transactions for the past year is respectfully submitted.

Since the organization of the committee, in February last, various subjects connected with the mechanic arts, and of very various grades of interest, have been submitted for examination, and have been referred to sub-committees for that purpose. By the rule of the committee, sub-committees are directed to hand their reports to the actuary within one week after their appointment, unless where the subjects before them require extended investigation; it is believed that a compliance with this rule has generally been aimed at, though, it must be confessed, not always with success. Of fifty improvements, or inventions, which have been laid before committees, reports have been made on forty-four. Of those which are not yet reported upon, a portion are such as require time to complete the examination. On the list of unfinished business, is that referred from the late Committee on Inventions, by the managers, to this committee, and relating to the premium offered, at the request of the Newcastle and Frenchtown Rail Road Company, for a plan for stopping the sparks which issue from the chimnies of locomotive engines, in which wood

is used as a fuel. This premium was offered in the list for the exhibition of domestic manufactures in 1833, and the inventions, in order to be entitled to compete for the premium, were to be submitted on or before October 1st, 1833. Several inventions were thus submitted, and, after examination, the late Committee on Inventions selected for trial such as they deemed most likely to answer the purpose designed; at the same time giving to all competitors the privilege of a trial of the apparatus described by them, if they still desired it, and furnished the apparatus. The sub-committee who have this matter in charge, reported, in March last, that measures had been taken to obtain the use of a locomotive, on Stephenson's construction, from the Germantown Rail Road Company; in June last, they reported that they had not received an answer to their official note, but had been promised the use of the locomotive of that rail road company, which was then under repair. In September last, this locomotive was understood to be still undergoing repairs. The postponement of the award of this premium is complained of by the competitors; but it is believed that the committee have done what was in their power, to execute the task imposed upon them. This subject may be thought worthy of reference to the General Committee.

The inventions, or improvements, brought before this committee, may be classed into those in which counsel, merely, is asked by the inventor, who withdraws his invention, if the sub-committee show reasons for an unfavourable opinion of it; and into those where the invention, patented or not, is brought before the public, independently of the opinions of the sub-committee. In both these cases, the practice of the committee has been uniform, although not regulated by resolution; when an invention is withdrawn, the sub-committee is, of course, discharged; when it is not withdrawn, but a report desired, the subject is brought, by this report, before the general committee, and a copy of the report, if adopted, is furnished to the inventor, by the actuary. When the subject has been considered by the committee of sufficient importance, the report has generally been ordered for publication in the Journal of the Institute, though on this point the committee have exercised a discretion. When the invention has been a patented one, the report of the sub-committee, when adopted, has been ordered for publication.

By an ordinance of our city councils, the award of the premiums and medals from the Scott's legacy fund, was vested in the Institute for seven years from February 27th, 1834; and by the managers of the institution, the duty of recommending such awards was confided to this committee. The regulations in regard to applications for these premiums, were published in our Journal, and in the newspapers of the day, and such publications will be continued by the standing sub-committee appointed for that purpose. By a late resolution of this committee, it has been made the duty of the actuary to furnish to all who may submit inventions to this committee, a copy of the regulations relating to the Scott's legacy premiums, and, by another resolution, sub-committees have been directed to

present such inventions as they may deem worthy of a premium, to the general committee. Notwithstanding the publications already made, the existence of this fund, and the liberal terms regulating the award of premiums from it, do not seem to be extensively known. By the words of the testator, the premiums were to be awarded to the ingenious, "who make useful inventions," and the rules throw no impediment in the way of merit.

Twelve models of specimens belonging to this legacy, and which have been received from the Committee of the Agricultural Society, who had charge of it, have been placed in the model room of the Institute.

A joint committee of members of this body, and of the American Philosophical Society, have been engaged in endeavours to promote the cause of meteorology, for the advancement of which so fine a field is open in our country. This they have judiciously done by directing attention to a set of observations, directed, as far as possible, to points which may be determined without the aid of instruments, namely, to the circumstances of wind, clouds, &c., attending on prevailing storms, their time of beginning, of ending, &c. It is to be regretted that the object of this circular has not always been understood, and that the additional remarks, intended for those who were willing to go further than this main object, have been interpreted as calling for a complete series of meteorological observations, which it was certainly not the intention of that committee to require from those who were willing to participate in their plans.

During the year there has been purchased, by subscription of members of this committee, and of others, a wind indicator, which, it is hoped, will, before long, be fixed up, so as to be seen in the reading room. The registry of the indications of this instrument will be very valuable for the objects proposed by the Committee on Meteorology.

In conclusion, it seems that the committee may congratulate themselves on the general usefulness of their labours during the past year, and that they have a right to expect, by a steady pursuance of the principles which have thus far guided them, that their sphere of usefulnesss will be much extended in years to come.

Very respectfully submitted.

A. D. Bache, *Chairman.*

Committee on Science and the Arts.

Report on Mr. Philos Tyler's Shifting Gauge Cock.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts, to whom was referred for examination a Shifting Gauge Cock, for Steam Boilers, invented by Mr. Philos Tyler, of Philadelphia, REPORT:—

That this gauge cock consists of a tube, with a long, sweeping bend, which passes through a steam-tight collar, or socket, in the

head of the boiler. When this tube is made to revolve in its socket, the motion of the end in the boiler corresponds to that of a radius from the centre of the socket; so that, if its radial length be six inches, the orifice will describe a circle three feet in circumference, and command a vertical line in the boiler, one foot in length. The lever which turns the plug of the cock outside of the boiler, has, when it is parallel to the head of the boiler, the same radial direction and length as the tube within; so that, when applied to the head of the boiler, it will always indicate the position of the inner orifice of the tube.

The utility of this contrivance is obvious at a glance, as a momentary inspection will show that, by means of it, the elevation of the water in the boiler, and its condition, whether of increase or decrease, can be ascertained with the greatest accuracy. It also possesses the merit of simplicity, and fitness for practical application, and will generally enable a prudent engineer to avoid the danger arising from a deficiency of water in the boiler.

The committee deem this invention a fit subject for an award of the Scott's legacy premium, as it possesses both the requisites of novelty and utility, and therefore recommend to the Board of Managers the adoption of the following resolution, viz:

Resolved, That when the requisitions of the Committee on Science and the Arts, with respect to the Scott's legacy premiums, are complied with by Mr. Philos Tyler, the award of a premium and medal be made to him, for his invention of a shifting gauge cock for the boilers of steam engines.

By order of the committee.

WILLIAM HAMILTON, *Actuary.*

November 13th, 1834.

Report on Mr. James D. Woodside's Perambulator.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts, to whom was referred for examination, a machine invented by Captain James D. Woodside, of Washington city, D. C., for ascertaining the rate of a vessel's motion through the water, REPORT:—

That they have had the same under their examination. This machine, called a Perambulator, consists of several parts, which we will endeavour to describe. First, the water wheel, about four inches in length, and twelve inches in circumference, (proposed to be graduated by actual experiment,) made with four wings, or floats, fixed on pivots, and so constructed that their flat surfaces are exposed to the action of the current when in a certain position; and during the revolution of the wheel, they move on their pivots, and present their edge, when opposed to the motion of the current. This wheel is inserted one-half its diameter into the stern post, about two feet below the water line, when the vessel is light, so as not to be affected by the motion of the water at the surface; on the axis of this

wheel, which is vertical, is an endless screw, driving a wheel containing 132 teeth, whose axis lies horizontal, and on which is a screw, driving a wheel with sixty teeth, placed on a vertical shaft, and extending up the stern post to the cabin, or other convenient place, on which is a screw, driving a wheel with forty teeth, placed on a horizontal axis, passing through the dial, and carrying a hand which indicates the distance, in miles, that the vessel has run. One revolution of the last mentioned wheel is sixty miles, corresponding with the divisions on the dial.

The principal feature of Captain Woodside's machine, and on which he rests his claim of novelty, is the peculiar form of his water wheel, with the movable wings, or floats; he has been anticipated in the application of the same principle to windmills.

One objection presents itself to the minds of the committee, viz: a vessel going at the rate of ten miles per hour, would require the water wheel to make 880 revolutions per minute, and the probability is, that in a short time, running with such velocity, the wheel would be rendered useless, by wear; therefore the committee cannot, with confidence, recommend the above described machine. There may be practical difficulties that they cannot foresee; although there have been machines nearly similar attempted at various times, they have never come into general use.

As experience is the best criterion to test the utility and durability of this machine, we think it worth a trial, it not being attended with much expense, and being a great desideratum with navigators to have an instrument that would indicate the true distance the vessel has passed over.

By order of the committee.

WILLIAM HAMILTON, *Actuary.*

Nov. 13*th*, 1834.

Report on Mr. Thomas Hutchings' Hydraulic Apparatus.

The Committee on Science and the Arts, constituted by the Franklin Institute, of the State of Pennsylvania for the promotion of the Mechanic Arts, to whom was referred for examination, by Mr. Thomas Hutchings, of Reading, Berks county, Pennsylvania, a new principle of action, and machine designed to put it in operation, REPORT:—

That they have examined Mr. Hutchings' drawing, descriptive of a machine, the action of which is to be derived by the agency of what he terms a power wheel, which is to be propelled by means of "balls of wood, or some other floating substance," applied at, or near, its virtual centre, on which they are to act by gravity, similar to that of water on an overshot water wheel, and when the balls successively arrive at the bottom of the wheel, they are to be conducted into a vessel, to which is attached a tube, of such capacity as fully to admit the balls to pass through it; which tube is to extend to the top of the wheel; the vessel and tube are to be filled with water, and when the

balls are forced into the vessel, they are to ascend through the tube, by their flotant power, to its top, whence they are again to be applied to the wheel; thus Mr. Hutchings supposes the wheel will be set in motion, and its action continued, requiring only a small quantity of water supplied to the tube, equal to the evaporation, and what may be carried off by the balls, in passing from it to the wheel. Your committee deem it unnecessary to describe in detail the machinery by which Mr. Hutchings proposes to conduct the balls into the vessel at the bottom of the wheel, or the water to the top of the tube, believing that the failing of the supposed action will be apparent, by simply stating that more power will be required to force these balls into the vessel, against the head of water contained in the tube, than their gravity can effect in descending through the same perpendicular space on the wheel.

It is evident that the *quantity* of power required to cause each ball to enter against an opposing head of water, will be in proportion to its bulk, whilst its effect to turn the wheel will be as its weight only. Hence, if balls of half the specific gravity of water be used, more than double the *quantity* of power will be required to force them into the vessel, than can be reproduced by their action on the wheel.

Had the inventor proposed to inject water into the vessel, thus causing a similar quantity to flow from the top of the tube to a well constructed water wheel, his object would have been more nearly approached than it can be by means of his balls; *either* of those modes, however, will fall far short of producing and maintaining the motion of the machine itself, much less of effecting any useful purpose.

By order of the Committee.

WILLIAM HAMILTON, *Actuary.*

Jan. 8th, 1835.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN AUGUST, 1834.

With Remarks and Exemplifications, by the Editor.

1. For a *Cooking Stove;* Horace Bartlett, Carmel, Putnam county, New York, August 1.

The claim in this patent is to the "extending the bed of the fire so far back that it receives long wood, in such a way that only about one-half of it is burning at the same time, unless the draft door is opened at the back, which may be done when more heat is required; thus putting in long wood, and leaving it perfectly under the control of the manager, consuming no more than what is required for immediate use, thereby saving the expense of cutting the wood into short pieces; thus acting somewhat like the principle of burning coal from the base, but applied to wood for a cooking stove."

The description given of this stove is very imperfect, but it is very well represented in the drawing; and, according to this, the fireplace

consists of a shallow, rectangular box, long enough, we suppose, to admit sticks of wood of two feet in length. This oblong box has doors at each end of it, for the admission of air, and upon it stands the oven, flues, &c., in the form of an ordinary cooking stove. In the projecting end of the lower box, or fireplace, and also in the top plate, above the oven, there are openings for kettles, &c.

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2. For an improvement in the *Apparatus for Tanning;* James R. Deniston, Connersville, Fayette county, Indiana, August 1.

In the petition, it is stated that the improved apparatus "consists of a vat protected from freezing in the bark house, in which is manufactured ooze of every desirable quality, from which it is strained off into a general reservoir, from whence it is dispersed, as required, throughout the yard, or raised to an elevated vat, and then dispersed, all by means of pipes, so placed under ground as to prevent freezing. The hides are hung perpendicularly in the vats of the yard. By means of this improvement, there is a vast saving of labour and bark; at least twice the usual expedition; and excellence in tanning is secured, and no weather prevents the usual operations of the yard."

The foregoing is so perfect an epitome of the specification, that we deem it unnecessary to give any thing more. There is no claim made, and from the tenor of the description given, and the accompanying remarks, we apprehend that what is intended to be patented is the securing the tanning liquor from the influence of frost; this, however, ought to have been distinctly stated, as, in the detail, many things are described which are common in tan vats, and are not, therefore, patentable.

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3. For a *Washing Machine;* Avery B. Gates, Connersville, Fayette county, Indiana, August 1.

This patentee also has given, in the petition to the Secretary of State, a short description of his machine, which, as it suits our purpose, we shall copy. Those who are learned in the history of washing machines, will see, from this description, that there is little, or nothing, upon which a legitimate claim could be founded; the patentee, himself, has not attempted to make any.

"This machine consists of a box, set on legs;—a shoe, or concave bed, is let loosely into the box; the inner part of this shoe is in the form of a semi-cylinder, filled with rolling rounds, so as to admit a cylinder filled with stationary rounds. Elasticity is given to the shoe by means of wire springs, placed in the corners of the box; the shoe is raised or lowered at pleasure, by means of rods passing through the springs, &c. &c."

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4. For an improvement in the mode of constructing the roofs of buildings, and a *Composition for Covering all kinds of Roofs, Brick or Stone Walls, Boards and Timber, exposed to*

the Weather; Daniel A. Balcom, Northampton, Bucks county, Pennsylvania, August 1.

The compound, resinous cement, here patented, is composed of eight parts tar, four parts rosin, and twelve, or fourteen, parts of finely pulverized dry clay, which are to be mixed together, and boiled until all the water has evaporated. Care must be taken that the ingredients be so proportioned, heated, and incorporated, that the mixture shall not be liable to melt and run by the action of solar heat, or to crack by its contraction from cold. The cement is to be laid on with a hot trowel, and all cracks and interstices must be carefully filled up. Among the purposes to which it is proposed to apply it, the coating of ships' bottoms, instead of copper sheathing, is mentioned.

The patentee says that "the application of the cement to the before named purposes, is what is particularly claimed, the chemical union of rosin and clay having been known before."

We are very certain that such a claim is altogether nugatory; the kind of cement described, that is, one substantially the same, has been made and used almost from time immemorial; there is little or no novelty in the application of such a cement to the purposes designated, and even if there were, we do not believe, as we have frequently had occasion to say, that the mere application of a known article to a purpose analogous to that to which it has been repeatedly applied, can be accounted an invention.

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5. For an *improvement in the Thrashing Machine;* John Marshall, Jr., Sweden, Monroe county, New York, August 1.

The so-called improvement is rather an appendage to the thrashing machine, as it is intended to agitate and carry away the straw, after it has been passed through the ordinary beaters. An endless apron is to be made by taking two long ropes to form its sides, or edges, and from one to the other of these ropes, slats, or wires, are to extend, parallel to, and within an inch or two of, each other. This apron is to be stretched upon, and to pass over, rollers, and upon it the straw is to be delivered as it is thrashed; it is to be of such length as to carry the straw out of the barn, and, during its passage, a beater is to strike upon it, to agitate the straw, and shake out the last portions of grain. It is to be moved by the same power which gives motion to the thrashing machine.

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6. For a *Truss for the cure of Hernia;* Thomas Lawrence, Clarke county, Kentucky, August 4.

A pad is to be made of wood, which may be round, and from two to five inches in diameter. The side intended to be worn next the body, is to be convex, and the opposite side flat; this pad, or block, is to be perforated through its centre, to admit a wooden pin to slide in it, which pin has a head of such size as shall pass into, and bear upon, the ruptured cavity. In the drawing, the sliding shank is represented as of about half an inch, and the head about an inch, in

diameter. The pin is acted upon by two spiral springs upon the back of the pad, which are to press upon it, at first, with considerable force; the intention, it is presumed, is to irritate the part, so as to produce inflammation and adhesion; this, however, is not said. The pressure is to be gradually diminished as the cure proceeds. The pad is to be kept in its place by suitable straps round the body. There is no claim made.

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7. For a new manufacture of *Figured Fabrics;* John Smith, Shaeffers-town, Lebanon county, Pennsylvania, August 4.

(See specification.)

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8. For a *Blacksmith's Striker;* Joel Woodel, Jackson, Madison county, Tennessee, August 6.

The apparatus described and figured as the subject of this patent, is so similar to that patented by Mr. Lewis Stripe, of North Carolina, and described at p. 172, vol. xiii., that we do not see how it can stand in law, unless patents can be obtained for each of the states individually, and each of them can find a true and original inventor of the same thing.

This striker has become the subject of altercation between two previous patentees, and if the declarations made by persons claiming to be informed on the subject, are worthy of credit, the invention is much older than either of their patents, having been long known and used in North Carolina. The present patentee does not prefer any claim.

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9. For a *Cast-iron Sink;* Zenos Tarbon, Franklin, Delaware county, and Levi B. Tarbon, Oneonta, Otsego county, New York, August 6.

The description of this affair is so very brief, that it would seem impossible to say any thing about it in fewer words than those used by the patentees, which are: "The sink is thirty inches in length, and twenty inches in width, with a soap dish in one corner, and a hole through the bottom to let off the water; all of which is made of pot metal, and cast whole."

We do not admire long-winded specifications, but still, having some portion of curiosity, and some sense of justice, we should like to know how to mete to each of these joint inventors his due portion of the mental labour expended in inventing the discovery by them set forth. The form of this said sink has nothing new, and is not, therefore, the invention of either; nor is cast-iron, or "pot metal," a new *composition of matter.*

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10. For improvements in the construction of *Bee Hives,* and *the Management of Bees;* Levi H. Parish, Brighton, Monroe county, New York, August 6.

In the construction of the hives here recommended, there is nothing very peculiar; but they are to be large, and to be divided into separate

compartments, by means of smaller boxes fitting into them, which boxes may be removed and replaced at proper periods. The main thing insisted upon is the advantage of keeping the hives within doors, in the upper rooms of a dwelling, or other suitable building. The benefits resulting from this are fully set forth, with much earnestness and good sense. The specification, in fact, would be a very good article for a journal devoted to the useful arts, but for the purpose of securing any exclusive right or privilege, it is altogether useless. The housing of bees in the manner directed is not new, nor is the dividing of a rectangular hive into compartments, by separate boxes, a thing which could be claimed at the present day; yet these two points are among the most conspicuous of those presented to us; even were they new, as they are not distinguished from other things which accompany them, and which are not so, they would not be secured to the patentee, whose business it is to distinguish his invention "from all other things before known or used," instead of which, not a syllable appears in any part of the instrument, which can lead to a knowledge of what was intended to be patented.

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11. For an improvement in *Weavers' Harness;* John Blackmar, Killingly, Windham county, Connecticut, August 7.

"What I, the petitioner, claim as new, and as my own invention, is the so constructing the harness as to have a fixed tie, or knot, in the lower end of the eye, where loops have been heretofore used. In the common harness, in the operation of springing the web, the loop is liable to work, or slip, in the eye, and thus fret out either the twine of the eye, or the loop, before the rest of the harness is worn out."

The drawing which accompanies the specification, represents the common mode of forming the loop, and also the manner of tying the knot employed by the patentee. Although the practical advantage of his mode is insisted on by the inventor, it is by no means apparent to one who is not thoroughly initiated in the art and mystery of weaving. How this new kind of knot is tied, we cannot tell in words, albeit we know something of a knot which words will tie; and not thinking it necessary to employ the engraver, we must refer those who wish to know more upon this subject, to the proper office.

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12. For an improvement in the art of *Manufacturing Nails;* Freeman Palmer, Buffaloe, Erie county, New York. Patent first issued October 25th, 1832; surrendered, and reissued upon an amended specification, August 7.

The present specification does not vary essentially from the former, which was noticed at p. 233, vol. xi. The claim now made, is to "the peculiar mode of making nails, as before described, with the peculiar shape of the rollers, to give a proper formation to the plates for the heads and blades of the nails; and in the form of the cutters, or knives, to give the required shape to the nails." The former claim

was altogether indefinite, and was one, the validity of which was, at the least, very doubtful.

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13. For an improvement in the construction of the *Saw Mill;* Thomas Blanchard, city of New York, August 8.

A circular saw is to be used to cut the timber, which timber is to be fixed upon a carriage, constructed and moving in the manner of the common saw mill carriage. The shaft of the saw runs in gudgeons upon a sliding frame, which is so constructed as to allow of its being shifted transversely to the carriage, in order to obviate the necessity for moving the log laterally, after a cut has been made. The different movements required are to be communicated by means of bands and whirls.

"The principle of this invention consists of the combination of a circular saw with a common saw mill log carriage, of any convenient construction; the said shifting carriage being made to slide at right angles with the log carriage; the thickness of the boards, plank, or other lumber to be cut, and to be firmly fixed in its position during the action of the machine, substantially as the same is above described. Circular saws are not claimed by this applicant, nor the construction of circular saws upon shifting or sliding carriages; nor does he claim a patent for the particular construction of the said shifting carriage, nor the index whereby the extent of its lateral motion may be adjusted and fixed. But the invention which he claims consists, as aforesaid, of the combination of a circular saw on a shifting carriage, constructed substantially as aforesaid, in any convenient form, and capable, by any convenient means, of being shifted and fixed in operation with a log carriage of any convenient construction; differing from the common and known saw mill in this especially, that the saw in these is not made to shift, but the log is shifted in its carriage, according to the thickness of the lumber to be sawed."

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14. For an improvement in the mode of *manufacturing Butt Hinges;* Dorwin Ellis, Attleborough, Bristol county, Massachusetts, August 8.

This patent is taken for the process by which the hinges are manufactured, there being, confessedly, nothing new in the machinery, which, in the present case, is merely adapted to the purpose to which it is applied. Strips of metal, about twelve inches long, and of a proper width, are to be cast with a projecting ridge along their whole length, which ridge forms the knuckle, or joint, of the hinge. The strips, or plates, so cast, are to be passed between rollers, having grooves in them corresponding to the ridge in the strips; by this means, they are equalized, and are then to be placed in a screw, or other press, where they are cut off, and the joints formed. The blanks, or halves, are next to be fixed in a drilling machine, of the usual construction, after which they are ready for the pins.

The patentee says, "I claim no exclusive property in the construction of these several machines, but I claim the successive application of them in effecting my said process of manufacturing butt hinges, as above mentioned. And also the particular form of the metal plates, or ingots, with which I commence my process."

Patents are granted for "any new and useful art, machine, manufacture, or composition of matter," and if the foregoing patent is valid, we think that it must be so in consequence of its standing in the first category, and, therefore, that it should be designated as "a new art, or process, employed in the manufacturing of butt hinges." We presume that it would be so considered in a court of law.

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15. For an improvement in the single twist *Screw Auger;* Nathaniel C. Sanford, Meriden, New Haven county, Connecticut, August 8.

The single twist auger is that sometimes known under the name of L'Hommedieu's auger. The improvement made by the present patentee consists in adding a second cutter, or lip, similar, and opposite, to that with which the instrument is ordinarily furnished. Directions are given for forging the auger so as to form these lips in a convenient manner; and it is said that when thus formed, it unites to the good properties of the single, those of the double screw auger, and is, therefore, superior to either. The patentee claims only "the formation and addition of a second lip to the common, single twist, spiral screw auger, which has hitherto been made with one lip only."

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16. For an improvement in the spiral *Screw Auger;* Alfred Newton, Meriden, New Haven county, Connecticut, August 8.

This, instead of a two, is to be a three lipped auger. The part which is to form the spiral, is to be first forged into a triangular form, and each of the sides is then to be hollowed, or fluted, by means of a suitable swage. For an inch auger, these hollows should have a depth of about three-eighths of an inch, and in the same proportion for other sizes. The cutting edge is to be so forged as to allow of the formation of three lips, and an entering screw with three threads. This auger, when twisted in the usual way, will, it is said, "be stronger, and bore more easily, than those of the ordinary construction."

The claim is to "the formation of an auger with three lips, or cutters, and a triple spiral, in contradistinction to the augers now made, which have not more than two lips, and a double spiral."

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17. For a *Fire Engine;* Thomas A. Chandler, Norfolk, St. Lawrence county, New York, August 8.

The description refers throughout to "the model," but there is also a drawing, making the construction sufficiently clear.

At the end of the description, we are informed that "The machine will receive and discharge twice the quantity of water, in the same length of time, with half the manual labour of the common fire en-

gines;" which most certainly is a very great mistake. We really believe that it would be much nearer the truth to say that, with double the manual labour, it would throw half the quantity of water of the common fire engine; we are ready to confess, however, that this, though true, would be a libel, as it would be calculated to make an unfair impression; but, most certainly, the friction in this engine will be, at least, twice as great as that of ordinary engines discharging the same quantity of water. There are to be four cylinders, their centres forming a rectangle, and their pistons having rods formed into racks, which take into segment wheels, upon the shaft of the levers that work the pistons. The water, from the four barrels, is to be forced into a common receptacle, furnished with an air vessel, and with two discharge pipes, in order, if necessary, to play two streams at once.

The claim is to "the *arrangement* of the several parts, so as to produce the engine herein described."

It requires no great portion of mechanical knowledge to enable any one to decide that the rubbing surface of four pistons is much greater than that of two of equal capacity, and of the same length of stroke; that a rack and segment wheel is by no means the best arrangement for working a piston rod; and that the increased number of valves and water ways must be attended by a considerably increased resistance.

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18. For an improvement in *Machinery for Dying and Printing;* James Rennie, Lodi, Bergen county, New Jersey, August 8.

The specification informs us that the invention here claimed is "an improvement and combination of machinery for dying, stamping, or printing, two or more different colours, mordents, or shades, at one impression, which improvement and combination I denominate the *magic sieve.*" This is followed by a transcript of the whole of the specification of the patent obtained by the same gentleman, on the 9th of June, 1834, and noticed at p. 31; and this is succeeded by a description of the *magic sieve,* which consists of an extension and variation of the same principle, or combination, that was the subject of the former patent.

The space occupied by the horizontal plate on which the sponge, &c., was to be placed, as described in the former patent, is to be divided into two, or more, compartments, by vertical, metallic partitions; and each of these compartments is to be supplied with a separate colour, by the means there set forth. The block with which the printing is to be effected, is to be so constructed that it will span these partitions, and allow the different parts of it to dip into the respective colours. "By applying the type, form, or block, to the sponge, or sieve, within the spaces, the different colours and shades will be communicated to the appropriate parts, and may then be stamped, printed, or impressed, on the cloth, paper, or the material to be printed, at one impression."

"The above constitutes a description of the improvement and combination of which I allege and claim the invention."

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19. For a *Churn;* Joshua Ricker, Bangor, Penobscot county, Maine, August 9.

We cannot, in general, find much room for churns, but when their inventors make a claim, we always give it; in the present instance, there is one in the following words:

"What I claim as my invention, is the form of the churn, with a bottom half round, so that the ladle boards will play within one-fourth of an inch of the circular bottom, and thus all the cream is moved alike. It will separate every particle of butter from the milk, leaving none. I also claim as an improvement, the manner of putting in and taking out the shaft. There has been a great difficulty in churns heretofore used, when cream is very thick, in removing the butter from the milk in the corners of the churn, which the ladle boards would not reach. In this I claim an improvement, and also in the gear, and form of the shaft, and also in making the shaft in two pieces, to prevent leakage. I also claim as my right, the privilege of increasing the number of ladle boards in the shaft to ten. I also claim as my improvement, the right of framing the body of the churn together." Many of which claims and rights no one will dispute, provided they are not exclusive, which several of them, certainly, ought not to be.

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20. For a *Composition of Matter applicable to the construction of Roads, Streets, &c.;* John Martineau, Eldridge, Onondaga county, New York, August 11.

The claim at the close of the specification of this patent, will exhibit clearly the object for which it is obtained.

"What I claim as my invention and improvement, is the application of tar, turpentine, or any other of that class of cohesive sub stances, reduced before use to a fluid state, and in that state used as a cement to apply to, and combine with, sand, gravel, pebbles, pulverized stone, such as is used for a M'Adamized road, or cobble stones; the interstices of coarse materials being in all cases filled, as well as may be, with sand and gravel, and cemented with tar, or turpentine, to form the wearing surface of roads, streets, &c., in the manner described in this specification, however the same may be modified or varied in practice. I also claim the application of the before mentioned cohesive substances, combined with sand, or other material, to the lining of canals, raceways, flooms, reservoirs, cisterns, &c. &c., in all the varied forms which practice may suggest, however modified, or varied."

We have, for many years, been in the habit of speaking of tar as one of the best articles which could be employed upon roads. Those who have noticed the wharves, or other places, where tar has been spilt on dusty roads, must have observed that it serves to cement the materials so firmly, that, after its incorporation with the dust,

or sand, is completed, the heaviest loads actually make no impression upon it.

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21. For *Hulling Clover Seed;* Benjamin Wood, Doylestown, Bucks county, Pennsylvania, August 11.

The clover is fed on to a sloping sifter, by the shaking of which it is to be separated from the straw; this sifter has a tight bottom, and above this a false one, which is perforated with holes sufficiently large to admit the seed to pass through. As the seed falls from the sifter into the hopper, through a vertical opening, it passes the mouth of a flue, leading from a revolving fan, the wind from which blows the clover and light stuff into the hopper, whilst stones, buck-horn, and other heavy articles, fall through the vertical opening, and pass out of the machine. At the bottom of the hopper there is a revolving cylinder, with its concave, on the ordinary construction.

The claim is to "the sifter, as above described, and particularly the separating principle by fan, wind, and flues, whether in the exact form or not, so as it effects the same purpose."

We cannot perceive any thing new in this sifter, or in the "separating principle," as that is fully described by Oliver Evans, in his "Millwright's Guide," published forty years ago.

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22. For a *Heat Retaining Cooking Stove;* John Moffat, Buffaloe, Erie county, New York, August 13.

Of this stove there is a very long, but, at the same time, a very inadequate, description, in consequence of which, after conning over six closely written pages of foolscap, we know but little about the actual construction of the affair; and the drawing, although very well executed, affords but little aid, as it furnishes no more than a view of the exterior case, with its doors. On arriving at the end of the specification, we had hoped that the inventor would there point out what he considered as new in his contrivance, but here also we were totally disappointed, there not being any thing in the form of a claim. We are told, however, that it possesses many virtues, as "it is the opinion of the inventor that, from its facility of retaining, and of emitting, the heat, as occasion may require; from the small quantity of fuel required to perform a large amount of service; from its ease of management, and a variety of other favourable circumstances, it possesses great advantages over any other stove now used for the same purposes."

From what we can gather in the specification, the main object in the view of the patentee was to construct a stove, which should be surrounded by reflecting and non-conducting substances, forming an inner and outer case. For this purpose, a wooden case is made, having its interior covered with sheet tin, which, however, is to be sustained at the distance of an inch and a quarter from the wood, the space between them being compactly filled with cotton. There must, of necessity, be a space of several inches between the case and the stove, in all directions. To allow of a free play of heat within

the case, the sides of the stove are, in part, constructed of vertical bars.

"The said 'self heat retaining stove,' so constructed, in manner and form hereinbefore particularly described, will retain the heat generated by the fire, within the case, so that the heat of the said fire can be used for cooking, or other purposes, without having any heat in the room in which it is placed. And it is so constructed that the said spaces in front of the grates, in the front side of the stove, and also the back end, can be used at the same time with the space within the case on top of said stove, and with like effect, for like or different purposes."

As there is nothing claimed, every thing described is, of course, included in the patent, but, in this stove, there are many things in common with others, such as grates, flues, &c., a claim to which could not be sustained. We will at the same time observe, that in what appears to be considered by the inventor as the distinctive characteristic of this stove, he has been anticipated, Mr. J. Hurd, of Boston, having, in November, 1829, obtained several patents, in which the same principle was applied; tin reflectors, within an outer case, being employed in an oven, or other cooking apparatus.

As respects the compact lining of cotton, it would be altogether useless; the more flocculent such a lining, or stuffing, the better; and, in fact, to have air alone between the tin and the wood, if confined with moderate care, would be preferable to any other mode of construction, as it is a worse conductor of heat than cotton, or even than charcoal itself.

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23. For a *Fly Driver;* R. H. Faunt Le Roy, New Harmony, Posey county, Indiana, August 13.

The *fly driver* is "intended to keep, or scare, away, flies, moschettoes, and other insects, from beds, cradles, tables, and other places where said insects are troublesome, by means of fans, wings, brushes, curtains, or feathers, kept in motion by means of a machine, without the attention of any person."

Every one who is conversant with wheel work, and indeed those who are not so, can very readily conceive that a vertical case may be made, which may stand as a pedestal and column, and have within it wheels and pinions, kept in motion by a weight of thirty pounds, thence communicating a vibratory movement to a shaft at its upper end, whereby flies, &c. &c., may be driven, or scared, away. Many contrivances for this purpose have, in fact, been made, and some of them patented; of these, we will refer to two by Commodore Barron; for a "Fan for bed-chambers, dining rooms, halls, &c., moved by mechanism," Nov. 27, 1830; and a second, for an improvement thereon, patented June 13, 1831. The resemblance between those machines and that under consideration, is such as might be anticipated; the patentee of this last has not made any claim, and, if he had, we should not think his right worth a law suit.

24. For an improvement in *Fire Proof Wrought Iron Chests*, and in locks and fixtures therefor. First patented March 7th, 1826; patent surrendered, and reissued on an amended specification, August 13.

In the original specification, the manner of making this chest was pointed out, and nothing more included, probably, than what the patentee considered as exemplifying his improvements; they were not, however, claimed in any form, nor was there any thing to indicate in what his improvements actually consisted. The specification before us is of much greater length than the former, entering into various particulars, not there touched upon. There is, first, a description and drawing of the chests, as made of wood, and covered with wrought iron, as imported from France; and secondly, a description and drawing of the chest, as manufactured by himself, in order to point out the specific differences between them. A claim is then made to "the combination and application of the above described alterations and improvements on the old French chest, or safe, namely:

"1. The making the bevil rest, and bevil ends, of the door, or doors.

"2. The cast iron half globe round heads, for rivets, bolts, screws, and nails.

"3. The hinge or hinges as described, and seen in the drawings.

"4. The method of shooting forth lock bolts in different directions, at one turn of the key, as seen in the drawings.

"5. The manner the lock is screwed on the wooden foundation of the door, as seen in the drawings.

"6. The new additions of appropriate iron bearings at the four corners of an iron chest, to secure the castors to it."

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25. For a *Press Tub*, for pressing seeds, kernels, &c.; Francis Follett, Petersburg, Virginia, August 14.

The principal improvement claimed in this patent is the mode in which the strainer is made, that forms the bottom of the tub.

"The strainer is formed by making an iron hoop, say seventeen inches in diameter, half an inch thick, and three-fourths of an inch deep, more or less. This is to be turned true, and to fit exactly into the rebate in the cylinder. To form this into a strainer, I take hoop iron, of the same width as the aforenamed hoop, and of such thickness as I may prefer, say one-sixteenth of an inch, and this I coil round in the manner of the spring of a timepiece, leaving a small space, say one-sixteenth of an inch, between each coil, and continuing it until it fills the hoop entirely. This I confine in its place by passing rods of round iron through it, and through the hoop, or in any other suitable manner." "What I claim as my invention, is the forming of the strainer in the way described, and the manner of adapting it to the cylinders, for the purpose of pressing seeds, and other articles."

Some variations in the mode of forming the strainer are pointed out, which we do not deem it necessary to particularize.

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26. For a *Cooking and Heating Stove;* Samuel B. Sexton, Philadelphia, August 14.

The oven, and many other parts of this stove, do not differ in any essential points from such as are ordinarily constructed. The patentee considers his improvement as depending, principally, on the mode he has adopted of generating and conveying heat; he says, "For the purpose of generating and conveying heat, for the heating of apartments, I pass any convenient number of tubes of metal through the stove, from front to back, the plates being perforated to receive them; these tubes may be two or three inches in diameter, and, in general, they stand in a row parallel to each other, immediately over the fire, and under the oven. The open mouths of these tubes, in front, are covered over with a casing, which I call a conductor, as the air which is to be heated in the tubes, is conducted into them through it; tubes are to lead into each end, or other part of the conductor, from a cellar, or other apartment, or out of doors, to supply it with air. Over the open ends of the tubes at the back end, I place a cover, or drum, sufficiently large to embrace the whole of them, and to become a hot air chamber, into which it is to pass from them, for the purpose of being conducted into such room, or rooms, where it may be required."

"In summer, when the heating part of this apparatus is not wanted, the tubes which pass through the stoves may be removed, and the openings covered by plates, or stoppers."

"What I claim as my invention, is the manner in which the heating and cooking apparatus are arranged, and combined together, for accomplishing the object herein described. I do not claim any of the individual parts which I have mentioned, they all having been previously used, either separately, or combined in other ways; but not, as I believe, in the manner in which I have combined and arranged them."

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27. For an improvement in forming *Bodies for Hats;* William Nunns, city of New York, August 14.

Hair cloth, formed of horse, or other, hair, suitable for the purpose, and combined, if desired, with other filamentous substances, is to be formed into a body, and stiffened by any of the ordinary methods. The body so formed is intended, principally, as a foundation for silk hats, but it may be used with other material, or by itself, which use the patentee would consider as a part of the present invention.

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28. For a *Horse Power;* John A. Pitts, and Hiram A. Pitts, the former of Brinthrop, Kennebeck county, the latter of Livermore, Oxford county, Maine, August 15.

The improvement in the horse power claimed by the patentees, they denominate an "Endless chain and cog band."

In the specification of this patent, various modes are proposed of forming the endless bands, or chains, to sustain the wooden slats upon which the horses are to walk. There are also several modes suggested for taking off the friction of the movable floor, and also for preventing its swagging. In the first case, the patentees say, "We make two chains, similar to the flat chains used in common carding machines, only larger. The square or open link may be made of round rod iron, of any convenient size, according to the strength needed. Upon the flat links we fasten, by bolts or otherwise, logs, or slats of wood, of such thickness, length, and breadth, as will make the band of the required size. The two ends of this band being connected, the band then passes over two cog wheels, or drums, and thus the machine is ready to receive the horse."

As we have already remarked, two or three other modes of forming the chain are proposed; but some of them are, like the preceding, perfectly similar to such as have been previously adopted.

One of the methods of sustaining the revolving floor, and preventing its friction, is the forming an endless band of friction rollers, which run upon, and under, ways, in a manner that has been proposed and practised in other structures. All the different methods described, are distinctly and separately claimed.

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29. For a machine for *Doubling, Twisting, and Laying, Spun Tobacco;* James Maurey, Petersburg, Virginia, August 15.

This machine resembles, in its general construction, some of those used for doubling and twisting cordage, but so altered as to adapt it to perform the same operation upon tobacco, and thus to facilitate, in an important degree, the manufacture of twist.

The claim is to the construction, combination, and adaptation, of this machinery to the manufacturing of tobacco.

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30. For an improved *Oven;* Richard R. Tonge, Fryeburg, Oxford county, Maine, August 15.

An oven made of sheet iron, and set into a chimney jamb, in the manner well known, and long practised both in England, and with us, is shown in the drawing. and alluded to, but by no means described, in the specification; very properly, however, there is no claim made.

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31. For a machine for *Hatchelling Hemp, Flax, and Wool;* Daniel Treadwell, Boston, Massachusetts, August 18.

The specification of this patent refers throughout to the drawings, and we do not think that without them the construction of the machine could be understood; we shall not, therefore, attempt to describe it. The claim made is to the combination of the respective parts, as constituting the hatchelling machine."

32. For machinery for *Tarring Rope-yarns;* Daniel Treadwell, Boston, Massachusetts, August 18.

The patentee states that his improvement consists in three distinct parts. First, in the method of heating the tar; second, in rubbing, or untwisting, the yarn, for the purpose of saturating it with tar; and third, in the nippers for pressing out the superabundant tar.

As in the last patent, the aid of the drawings would also be requisite to a clear understanding of the operation of this tarring apparatus. The white yarns are wound upon bobbins, fixed in a proper frame, and the kettle in which the tarring is effected is a long trough, above which there are sliding bars, having perforated metallic plates at their lower ends; through these the yarns are passed, and by their means can be lowered into, or withdrawn from, the tarring kettle. The untwisting of the yarn is effected by a very ingenious contrivance, consisting of additional perforated plates, which have a motion communicated to them by means of cranks, in such a way that the yarn passes through the first named fixed plates, with the twist so far removed as to allow the tar to penetrate readily through the mass.

The claims made, are to the improvement in tarring by heating the tar by steam, as described; to the rubbing, and at the same time untwisting, the yarns, as they pass from the bobbins through the tar, so that it may penetrate between all the fibres of which they are made up; and to the manner of constructing the roller nippers, by which the superfluous tar is forced out from the yarns.

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33. For an improvement in the art of *Extracting the precious metals from their Ores;* John L. Sullivan, city of New York, August 18.

It is our intention to give a full description of the apparatus which forms the subject of this patent; but knowing that the patentee intends to introduce further improvements in the mode of procedure pointed out by him in his specification, we will, at present, merely observe, that by the machinery employed, the ores of gold, and more especially auriferous iron pyrites, are to be exposed, when pulverized, to the united influence of heat and motion; the heat being principally supplied by a current of air, which will carry off the sulphur, and other volatile matters, and thus leave the gold in a proper state to be separated from the ore by amalgamation, either in the same, or in an auxiliary instrument.

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34. For a *Thrashing Machine;* Isaac Gallop, Plainfield, Windham county, Connecticut, August 18.

This machine is nominally new, but substantially old. It is called the "New Thrasher," but consists of a cylinder set with teeth, and a concave similarly furnished, so much like others previously in use, that they might very well be confounded together. The patentee, however, seems to think otherwise, for he claims as new and useful, and of his own invention, the peculiar structure and position of the *concave base*, and its relative proportion to the cylinder; the arrange-

ment of the teeth on the same, and their peculiar contact with those on the cylinder. The position and effect of the bevil cogs, and the relative size and proportion of the several wheels, pulleys, cog wheels, to and with the motion wheels, and the cylinder, together with their combinations, are all new and useful in their results, and are a discovery of his own, and belong to no one else, and for these improvements and discoveries, this patent is claimed, and is to be known and designated by the name aforesaid, viz: "THE NEW THRASHER."

Should it be thought proper to add a winnowing, to this thrashing machine, we advise that great care be taken not to pass this claim through it, lest it disappear altogether.

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35. For an improvement in *Fire Ladders;* James Lee Hannah, M. D., city of New York, August 19.

A ladder is to be made in the usual way, but having the two sides parallel to each other. The topmost round is to be a bar of iron, which is to project through the cheeks of the ladder, and is to have a round roller, or wheel, at each end, which, by their rolling upon the wall are to facilitate the raising of it. The main ladder may be forty feet in length; but there are to be additional sections, each of from five to eight feet long, to be fastened on its bottom, when necessary; strong bolts at one end of these sectional pieces are to pass through staples at the lower end of the ladder.

A box called a safety box, is to be adapted to the ladder, having proper guides to cause it to slide securely upon its uprights, or cheeks; in order to elevate this safety box, there are to be two pulley blocks, one on each side of the ladder, attached to the iron bar which forms the upper round; ropes passing over the sheaves of these blocks, are hooked to the safety box, and men drawing at the other end, raise it to the top of the ladder.

The claims are to the rollers, the sliding safety box, and the sections to be added to the main ladder.

Numerous contrivances have been made to facilitate the escape of persons, and the removal of goods, from houses on fire, but they have never come into general use, and it is probable that they never will. Even the common fire ladders, provided by corporations, are usually suffered to pass into decay, in consequence, undoubtedly, of their being but very rarely employed, or wanted. As this is the case, they are never carried to fires until circumstances render it necessary, when they are apt to arrive too late to be useful. To be available in large cities, such machines must be very numerous; for those who are active at fires, expect to be most useful by immediate attendance; and those who are not so, will not run after, and carry, heavy ladders and their appendages; we do not believe, therefore, that the present patentee will meet with much encouragement in his undertaking.

In the eighth volume of Borgni's "Traité complet de Mécanique," plate 12, a fire ladder may be seen, furnished with rollers at its upper end, for the purpose designated in the present specification; we

could also point out drawings of buckets, or boxes, to be elevated by means of tackle, in the way described; and, indeed, we see nothing new in the present contrivance, excepting the parallelism of the two sides of the ladder, for the more convenient sliding of the safety box; and the particular manner of lengthening the ladder, as described.

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36. For an improvement in instruments for *Cutting and Crumbling the Stone in the Bladder;* James Lee Hannah, M. D., city of New York, August 19.

These instruments for cutting and for crushing the stone, are, when closed, in the form of a sound, or catheter, but considerably curved at the end which is to enter the bladder. According to the drawing, the shaft is straight, but the end is bent round so as to form a quarter of a circle of about three-fourths of an inch radius. This quadrant constitutes the jaws by which the cutting and crushing are to be effected; these jaws work on a pin near the extreme end, and when closed, form a round smooth body, having no projection to obstruct it in its entrance; its opening commences at the point where the curve terminates and joins the straight shaft. This straight shaft consists, exteriorly, of a thin silver tube; and through this tube passes a steel spring, like a watch spring, which, when pushed in, allows the jaws to open, the spring being attached to the jointed piece. The cutting instrument has edges like shears, the crusher opens like forceps, and has teeth to hold and crush the particles of stone which have been divided by the cutter.

There is an apparatus described, which is to be attached to the shaft when it has been inserted, for the purpose of closing the jaws of the cutter, or crusher, by a graduated and measured force. By the turning of a nut, a screw is made to draw upon the spring which closes the jaws, and between this screw and the spring, there is inserted a, spiral spring, weighing instrument, upon the slide of which the screw acts, and it is thus made to indicate the force applied, in pounds, or parts of pounds.

This description will give to the surgeon a general idea of the construction of the instrument. Whether it is really an improvement upon that of Civiale, experience must decide. The objections which immediately present themselves, in our view of it, are the abrupt curvature of its end, which may interfere with the facility of its insertion; and the use of the spring, jointed on to the jaw. The objection made to the instrument contrived and patented by Mr. Lukens, of Philadelphia, we have understood, was the use of his jointed springs for holding the stone, which might possibly break whilst in use—an accident of fearful import.

The things claimed are, "1st. The curve of the instrument being in two sections, one moving as a joint, or a screw or rivet, which serves as a fulcrum to the sections. 2d. The sections being formed with edges to cut, or with teeth to crumble, the stone. 3d. The groove in the shaft or handle of the crumbler. 4th. The application of the elastic

steel spring, by which the instruments are opened and closed. 5th. The application of the silver or other metallic tube, to keep that spring acting properly in its place. 6th. The application of the wooden trough, screw, and nut, as means of exerting power. 7th. The application of the rider to keep the hook of the wooden screw acting properly in its place."

We think that these claims enter too much into the particular formation of the individual parts of the apparatus, and that it would have been better to have claimed the instrument substantially as described, whether the particular parts are made precisely in the manner given, or varied in form only, whilst the principle of action is preserved.

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37. For a *Machine for Grinding Grain;* Joseph Grant, Providence, county of Providence, Rhode Island, August 19.

This is to be a cast iron mill, consisting of three cylinders and a concave, all of which are to be so fluted as to form teeth not more than a quarter of an inch wide, and an eighth of an inch deep. Two of the cylinders, with a hopper above them, are to be placed horizontally, and parallel to each other. The lower cylinder has a concave under it, which is adjustable by means of a screw. The cylinders are all to move with different velocities, the last with the greatest speed.

"The improvement, or discovery, consists in the combination, and in the variation of the speed of the several cylinders."

We should be more inclined to call this a machine for the breaking, than for the grinding, of grain; at all events, it will not make very fine meal.

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38. For a *Thrashing Machine;* Charles Wilson, city of New York August 19.

This machine is to have a frame made entirely of cast iron, and the concave is to be formed of triangular cast iron bars, about five-eighths of an inch thick, and an inch apart, allowing space for the grain to fall through between them. The whole surface of the cylinder is also to be of cast iron, consisting of bands, or hoops, four or five inches wide, and a quarter of an inch thick, with projecting pieces, for beaters, cast on them. These bands are to be driven on to a wooden cylinder.

The claim is to "the frame being entirely of cast iron, and its peculiar construction for strength and cheapness; and of the cylinder in introducing malleable cast iron with beaters solid to the bands, with the concave bars cast solid to six supporters, and substituting the same for movable bars and bands."

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39. For an improvement in the *Percussion Cannon Lock;* Enoch Hidden, city of New York, August 20.

The greatest difficulty which has been encountered in the construction of percussion cannon locks, has been the powerful reaction from the vent, by which the hammer has frequently been blown off,

and other injurious effects produced. Springs have been devised to throw the hammer out of the way so instantaneously that the reaction should not effect it, but the success in this point has been but partial. The main object of the present patent is the same, as will be seen by the following claim:—

"What I claim as my invention, and for which I ask a patent, is the manner in which I employ the reacting spring, as described under the various modifications thereof, as herein shown, by which the hammer is instantaneously thrown up, after striking the percussion cap directly upon the vent of the cannon. I also claim the manner of applying the corking lever under an arrangement by which it is made to be close to the case, or box, of the lock. Also, the spring catch, and the manner of working the trigger. And particularly the arrangement of the parts described in the second modification, by which the operation and effect therein mentioned, is produced."

The whole arrangement, with its several modifications, are well represented in the drawings.

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40. For a *Filtering Machine;* Isaac Wiseman, city of New York. An alien, who has resided two years in the United States; August 20.

The principal difference between this and the filtering vessels ordinarily employed, consists, first, in there being a separate vessel to receive the water which has been filtered, and which vessel can, therefore, be removed for the purpose of clearing it of the sediment which always finds its way into such reservoirs; and, secondly, in interposing between the layers of broken quartz, sand, charcoal, &c. perforated plates of earthenware, metal, or other substances, which will prevent their mixing with each other from agitation in removal from place to place. Such perforated plates are not new.

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41. For a *Revolving Turning Steel;* Benjamin E. Hoyt, Ipswich, Essex county, Massachusetts, August 20.

This steel is for turning the edges of curriers', or other knives, by passing a roller, instead of a burnisher, over them. This roller is a cylinder of hardened cast steel, which is represented in the drawing as about two and a half inches long, and three-fourths of an inch in diameter; this is bored through its axis, and revolves on a steel shaft, furnished with a handle at each end.

The patentee says, that the advantage of this instrument consists in its presenting a revolving instead of a fixed surface, to the edge it is intended to turn, by which means it is rolled, instead of rubbed; the operation of rolling leaving the edge perfectly smooth, whilst the rubbing is apt to leave it rough and broken.

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42. For an improvement in the manufacture of *Percussion Powder;* Samuel Guthrie, Sacket's Harbour, Jefferson county, New York, August 21.

(See specification.)

43. For a machine for *Separating Gold from the Soil;* John Dobson, Burke county, North Carolina, August 21.

This machine has an inclined rocker, similar to that used in many others, and various appendages which have no claim to novelty. After describing these, the patentee says: "although I have been particular in describing the construction of the above machine, yet I rest my claim only on those principles of the bucket, or receiver, by which a peculiar rolling motion is given to the mercury, most applicable to the collecting of the gold; which principles and advantages it may be necessary to mention as understood by me. In the first place, a larger quantity of mercury can be used than by the present mode, without danger of loss; and extending from side to side of the bucket, presenting a rolling edge to the approach of the gold, of sixteen inches in length. The column of water descending through the tube impinges on the sheet iron curve, at an angle of about forty-five degrees; the gold, being of greater specific gravity, slides intimately along the curve of the bottom of the bucket, until it meets the lower edge of the mercury, which, by the force of the water pressing upon it, is removed up the inclination of the opposite side, where, by a less force being exerted on the top than on the bottom, it is caused to roll over on the gold, thereby securing it by amalgamation; while at the same time, the force of the water expels nearly all the sand, gravel, &c. from or through the mouth of the bucket. The mercury being put only in the bucket, renders the inside ripple of the old machine unnecessary; the body being lighter, a brisker motion is attainable with the same force; a greater attrition is thereby given to the grit; and as a large quantity of water can be used, a separation between the mass and the gold is obtained with much greater facility than with the usual quantity."

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44. For a *Clover and Herdgrass Hulling Machine;* Reuben Ranger, Wilton, Kennebeck county, Maine, August 21.

This instrument need not detain us long, as there is little or no novelty about it, and no part of it claimed by the patentee.

The hulling is to be effected by rubbing the seeds between perforated plates of sheet iron, one portion of which is a conical body, and is made to revolve upon a shaft placed horizontally; this is surrounded by a concave similar in form, and surmounted by a hopper. The rubbed seeds pass out through an opening in one end of the machine, at the lower edge of the base of the cone.

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45. For an improvement in *Finishing Leghorn, Straw, Grass, and Palm Leaf Hats and Bonnets;* Joseph Snyder, city of Philadelphia, August 22.

The hats and bonnets are to be varnished with any of the known suitable varnishes, adapted to the colour of the article.

"The object intended to be attained by the foregoing improvement is to preserve hats and bonnets from moisture, that they may retain ther proper shape."

"The part believed to be new, and claimed as an invention or discovery, is not the preparation of any particular kind of varnish, but the application of varnish now known, to a purpose for which it has not heretofore been used; that is, to the purpose aforesaid of varnishing hats and bonnets of the description above mentioned; or to the purpose of varnishing the materials from which such hats and bonnets are made."

We do not know that the varnishing of such hats as are above mentioned, has been before adopted as a process in the manufacture; we, however, have known of straw hats being varnished with black sealing wax varnish, and of the insides of the crowns of such hats being rendered water proof, in the same way, and have worn one so prepared. Palm leaf hats, also, have often been painted for the use of sailors and others.

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46. For an improvement in the *Spinning of Rope and other Yarn;* Sidney D. Whitlock, Brooklyn, King's county, New York, August 22.

It is observed in the petition, that this patent is claimed for a "new application of the machine for which letters patent of the United States were granted to a certain Robert Graves, of Boston, on the first day of April, 1819."

In the specification, it is stated that the original machine is modified by the use of a double railway for the machine, or machines, to run upon; using at each end of the double track, a detached section of the track, made to revolve like the turnabouts upon rail-roads, so as to accommodate the equalizing machine. "Each track is furnished with an endless band and rope, operating as described in the specification of the said Graves' machine, herein referred to, alternately on the equalizing machines as they change tracks." The patentee states that he also, sometimes, places at each end of the tracks, the preparatory part of one of Westerman's patent hackling machines; he then adds, "What I claim as new, and for which I ask letters patent, is the application of the machine for making cordage, patented to the said Graves as aforesaid, to the spinning of rope and other yarn. I also claim the use of the double track as applied to said machine, or machines, and herein specified and described. Also the use in connexion therewith, of the preparatory part of Westerman's machine for hackling hemp, as above specified and referred to. Moreover I claim the right of varying the said machine, or machinery, as applied for the purpose, in any manner that I think proper, provided the principles remain unchanged."

If the patentee supposes that he can take from the public a machine to which they have a right, he is, most assuredly, mistaken. A machine for spinning cordage, is a machine for spinning rope, and were it not so, the machine, to whatever purpose applied, belongs either to the inventor or to the public, and we are apprehensive that the present patentee would have thought it unsafe to have used Graves'

machine during the term of the patent, without a license for so doing; the right of the public, however, is not less sacred than the right of an individual. For his own modification of the rail-way, he might have obtained a good patent, under the name of an improvement; as claimed, however, we think his right a nullity.

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47. For an improvement in *Shearing Machines for Shearing Woolen Cloth;* Reuben Daniels, Woodstock, Windham county, Vermont. First patented May 13th, 1834. Patent surrendered and reissued on an amended specification, August 22.

We noticed this patent, as first issued, at p. 394 of the last volume, to which we refer. After describing the whole machine in the new specification, the patentee says, "Although I have described the machinery and apparatus of the whole of a shearing machine, yet it is to be understood that what I claim, and all which I claim as new, and of my invention and improvement, is the construction of the rotary cutter with beads, wheels, or spiders, and a metallic sheet, or sheets, as aforesaid, or of cast metal as aforesaid, with the blades soldered thereto as aforesaid, and the use of rotary cutters so constructed, and made in machines, for the purpose of shearing woolen and other cloth, either from end to end, or from list to list; and the construction and use of the sliding rest aforesaid lapping over in the machine for shearing cloth from end to end, for the purpose of saving the listing, or selvages."

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48. For improvements in the *Power Printing Press;* Otis Tufts, Boston, Massachusetts, August 22.

We are informed in this specification, that "the principal difference between this power press and others now in use, consists in supplying it with paper to be printed from one side of the frame, by using two friskets, one of which is under the operation of an impression from the platten, while the sheet of paper last printed is being removed from the second frisket, and another sheet is applied. As soon as the frisket first mentioned has received an imprint from the types, it is withdrawn by the operation of the machinery from between the platten and form, and the second frisket caused to pass in between the platten and frame, there to be acted on in its turn. So in succession each passes out from between the platten and frame with its printed sheet, while the other with the sheet to be printed, is made to pass in between the platten and frame."

After this introductory account of the general principle upon which the press operates, its whole construction is fully described, the description being made perfectly clear by the aid of drawings, of which there are five, representing the machine in plan, in elevation, and in section, in a manner so complete, that a competent workman could at once construct such a press as perfectly as though he had the original by him. These drawings were executed by Mr. R. H. Eddy, Civil Engineer, Boston. We mention this fact, as it may serve to

direct patentees who wish to have this part of their application perfectly well executed.

The claims are very distinctly made, but to understand them fully, would require the aid of the drawings, and should this press sustain the character which we are inclined to give to it, not from the description merely, but from having seen it, although but for a short period, in actual operation, we hope hereafter to have the means of making its construction fully known.

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49. For a *Double Cylinder Truck, for raising stone, timber, &c.;* Simon Frieze, Waterloo, Anne Arundel county, Maryland, August 23.

This truck is to run up an inclined plane, or railway, formed of parallel timbers, rising at any angle not exceeding thirty degrees. Instead of four wheels, there are to be two rollers turning on gudgeons, one at each end of the truck. An offset is to be turned down at each end of the rollers, to form a shoulder, or flanch, to keep them in their places on the ways. The part turned down is to be champhered, to cause the truck to keep the track the more readily. At the upper end of the inclined plane, there is to be a block, with a rope passing over its sheave, one end of which rope is attached to the truck, and the other drawn by horses, or other animals, to raise the load.

"The patent claimed is for the offsets of the cylinders, by means of which the truck is kept in its proper position on the track, or frame, so that burthens can be raised with greater expedition, less danger, and less power employed."

The parts of the cylinders which are to operate as wheels, do not differ in any respect from the wheels of rail-road cars, having flanches, and cones, or what is above called a champher, operating upon precisely the same principle. The cylindrical part is, in effect, nothing else than an enlarged axle, and has nothing whatever to do with the action of the thing, as described.

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50. For a machine for *Hulling Clover, and other small Seeds;* Merit Baily, Attleborough, Bucks county, Pennsylvania, August 23.

This machine consists of a combination of cylinders, a concave for rubbing, riddles, a fan for cleaning, &c. &c., all of which are well known as parts of other machines. After describing the whole, a claim is made to "the application of the riddle, or sieve, at either one end or the other of the double case, for the separation of the buckhorn, &c. Also, the small roller being coated with cement alone, without teeth, &c. And for the application of the friction rollers to the main cylinder axis."

The things claimed are, in part, at least, of more than doubtful originality; the cement upon the small cylinder, for example, is to be of sand and glue, a coating similar to which has been repeatedly used; but the idea of claiming the running of the gudgeons of the

larger cylinders upon friction rollers, is one of which few persons would have dreamed; as, unless the patentee has lived through a century, such rollers were public property before he was born.

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51. For a *Horse Power;* Joseph B. Streeter, Middlesex, Yates county, New York, August 26.

In this horse power, the animal is to walk in a circle, in the usual way, but the horizontal shaft, which he is to draw round, revolves on its axis, the inner end of it turning in a revolving cap, placed on a post fixed in the centre of the circle; near this end, the shaft carries a face, or crown wheel, which mashes into a wheel on a vertical shaft, the lower end of this shaft being sustained by, and turning upon, the upper end of the post before mentioned. The outer end of the horizontal shaft carries a cog wheel, which rolls upon a circular platform, or rim, laid upon the ground, and has mortices in it to receive the cogs of the last named wheel; these mortices insure the revolution of the wheel, and consequently that of the shaft to which it is affixed. On the top of the vertical shaft in the centre, there is a cog, or band, wheel, for the purpose of communicating the motion obtained to any machinery.

This is manifestly much more complex than the old-fashioned horse mill, and the patentee does not point out those particulars in which he deems it superior to it, and upon which its claim to utility is dependent; nor does he say one word with respect to those parts which he considers to be original, concluding, probably, that such is the case with the whole arrangement; by turning, however, to p. 311, vol. xi., it will be found that this horse power has been anticipated, in all its essential features, by Mr. R. S. Schevenell, of South Carolina, who obtained a patent therefor, on the 13th of November, 1832.

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52. For *Jointing and Manufacturing Staves for Barrels, &c.;* Cyrus M'Gregory, Newport, Sullivan county, New Hampshire, August 26.

The machinery described is so imperfectly represented in the drawing which accompanies the specification, as to render it extremely difficult to obtain a clear idea of its construction, the main dependence, in this respect, being manifestly placed upon the model deposited in the patent office. All that we can say, is, that the jointing is to be effected by a wheel revolving vertically, and having a number of irons on its face, near to its periphery. The stave is to be held in a gauge, and sustained upon a suitable rest. The patentee says that "The principle upon which this improvement is constructed is, that when the stave is bent on the upper surface, or edge, of the gauge, the bilge part of the stave is much further from the centre of the circle, of which the semidiameter of the cask forms a segment, than the ends, as the bilge is deeper than the ends of the cask; as also the outside of the stave is further from the axis of the cask, represented by the lower edge of the gauge, than the inside part of the stave. This gauge, thus applied, gives both the true bilge and bevil to the staves,

when jointed. This improvement, then, consists in the construction and application of said gauge for holding and gauging the staves to the revolving jointer, which wheel, or revolving jointer, is not my invention, but has never before been applied to the jointing of staves for casks."

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53. For an improvement in the surgical instrument called a *Scarificator;* George Tiemann, city of New York, August 26.

The *improvement* in the construction of the Scarificator, which forms the subject of this patent, appears to us to deserve the appellation, as we think that both in construction and in operation, it will be found superior to those made either in the English or the German manner. The patentee, after describing the usual mode of forming this instrument, informs us that the principal improvements made by him are, the use of pointed lancets, instead of those with rounded ends; a contrivance for using them with more exactness, and so as to cause less pain, and produce a more profuse bleeding than heretofore, whilst the mechanism is more compact, and more easily kept clean, and in order, than in the old instrument.

The lancets, instead of standing in rows upon an axis, or shaft, are all fixed upon a flat plate, which fits into a box, similar to those now in use, but smaller. For the purpose of moving the plates containing the lancets, an axis and jointed levers are placed under it, which are operated upon by suitable springs, and other appendages, that are fully described, and perfectly represented in the drawing. There is no distinct claim made, but the difference between this and other instruments for the same purpose, is clearly designated, so as to leave no doubt whatever respecting the points upon which the dependence for originality is placed.

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54. For *Stoves for Burning Coal;* Abial Smith, North Providence, Providence county, Rhode Island, August 27.

What is viewed as the peculiar characteristic of this stove, is, there being two openings in front for admitting the draft of air to the fire, one of them above, and the other below, the surface of the fuel. An oven is placed behind the fireplace, with a flue passing above and below it, either of which may be closed by a damper. By this construction, the draft may be admitted above the fire, to pass downwards through it, and under the oven, or it may be admitted below, in the ordinary way, and directed over the oven.

"What I claim as my invention, is the construction by which the draft is applied to the top or upper part of the coal, and conducted downward through the coal, under the oven. The objects attained are, first, when the draft is introduced at top, the ashes fall away from, instead of towards, it, and do not clog the draft; and secondly, by the alternate use of upper and lower drafts, the greatest degree of heat is applied at pleasure to the parts where it may be wanted, for culinary or other purposes."

55. For a *Thrashing Machine;* John Matthias, Manchester, Baltimore county, Maryland, August 27.

The general construction of this machine is the same with the greater number of those in use, operating by a cylinder and concave; the point claimed as an improvement, is the mode of forming the teeth. Those upon the cylinder are to be of wrought iron, about two inches in length, half an inch in thickness, and two inches wide at the base, diminishing to about half an inch at the top; the width allows of a shoulder at the lower end, upon which a sharp tine, or shank, is formed, to be driven into the wood. Six rows of these are to be set at about one inch and a quarter from each other. There are to be similar teeth upon the concave, but the operating edges of these, instead of rising in a straight line, like those on the cylinder, are to be hollowed, or curved, so as to form them into hooks; and this is stated to afford the principal advantage offered by this machine, as these hooks tend to draw the straw in towards the teeth, and consequently operate upon it to greater effect. The only thing claimed is the "using these hooked, or curved, teeth, as above described."

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56. For a *Bedstead for the Sick*; William Woolley, city of New York, August 30.

This bedstead is represented in the drawings under four different modifications, the particular arrangement of certain parts of each being claimed. The objects proposed are the same as those which have, in numerous instances, been attained in other bedsteads for invalids, and we do not see any thing in the present apparatus superior to those which have preceded it; the patentee has a right to his own modes of accomplishing his purpose, and to these his claims refer.

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a Patent for a New Manufacture of Figured Fabrics. Granted to JOHN SMITH, *Shaeffers-town, Lebanon county, Pennsylvania, August 4th,* 1834.

To all whom it may concern, be it known, that I, John Smith, of Shaeffers-town, Lebanon county, in the State of Pennsylvania, have invented a new manufacture of woven figured stuffs, such as carpeting, coverlids, table covers, and various other articles, either in single or mixed colours; and I do hereby declare that my said invention consists principally in the manner of preparing the chain, to form the ground, or basis, of such articles, and that the following is a full and exact description thereof.

I make the chain of the various articles which I manufacture, by taking two double, and one single thread, alternately, and in weaving the figures, the filling never floats over more than five threads; that is to say, over four double and one single thread, instead of over nine threads, as in the ordinary mode of weaving. The filling is

also in part of single, and in part of double thread, the single thread being employed to bind, or interweave with the double thread of the chain; and the double thread of the filling, which is usually of woollen yarn, is bound by the single thread of the chain. By forming my patterns in this way, no part of the fabric is loose from, but is interlocked with, the pattern on the opposite side of the cloth, and adegree of firmness, and distinctness of pattern, is given, which cannot be attained by the use of a chain composed entirely either of double or of single threads, whilst, at the same time, each thread of the filling interweaving with one of the chain, at shorter intervals than in the ordinary mode of weaving, the article is rendered more durable, and the double thread of the filling being bound down by the single thread of the chain, the pattern formed by the double filling is left as distinct in its form and colours, as in the more loose fabrics, in which the filling floats, or passes, over a greater number of threads.

All the variety of patterns given to goods of this description, may be produced in my mode of weaving, and although I have made some improvements in the loom which I use for the purpose, similar articles may be woven in the ordinary figure loom; I do not, therefore, describe, or claim, any particular machinery for effecting the object in view, but claim only the arrangement of the double and single threads in the chain, and in the filling, applied in the manner, and for the purpose, herein described. Although I have spoken of double and single threads, both in the chain and filling, it is to be understood that these denominations respect the size of the threads employed, rather than the mere fact of their being double, or single, as a double yarn may be employed in lieu of that which I denominate single, provided its fineness was such as to produce the intended effect, and a fine double yarn thus used, I should consider as interfering with my invention, as it would enable the weaver to produce a manufactured article essentially similar to that described.

JOHN SMITH.

Specification of a Patent for an improvement in the manufacture of Percussion Powder. Granted to SAMUEL GUTHRIE, *of Sacket's Harbour, Jefferson county, New York, August 21st,* 1834.

To all to whom these presents shall come, be it known, that I, Samuel Guthrie, of Sacket's Harbour, in the county of Jefferson, and State of New York, have invented an improvement in the manufacturing of percussion powder, for the discharging of firearms; and I do hereby declare that the following is a full and exact description thereof.

I prepare the percussion powder from any of the materials employed for that purpose, using fulminating mercury, detonating silver, and oxide of tin, or regulus of antimony; chlorate of potash with charcoal, sulphur, sulphuret of antimony, or any mixture of substances capable of inflaming gunpowder, by percussion, forming the

same into a paste, and granulating by processes which are well known; sometimes making the grains of a small size, like those of ordinary gunpowder; at other times, I make them of such size that a single grain suffices for a priming, and is substituted for the copper caps used in fowling pieces, muskets, &c.; or still larger, so that they may be used for the discharge of ordnance of all descriptions. These grains are so compounded, that they are hard enough to be packed up, and carried about, without being liable to be crushed by their abrasion against each other, or by any force to which they are ordinarily subjected. These grains are rendered water-proof by coating them with shellac, dissolved in alcohol, or any other resinous varnish. Such powder I have, for some time, been in the habit of manufacturing and vending; but I have recently made an improvement therein, which is as follows. Before the varnish with which the grains are coated is perfectly dry, I cover, or coat, them with some metallic substance; and this I do by taking leaf metal, or any of the metallic powders known under the name of bronze, or bi-sulphuret of tin, or any other metal, or metalline compound; and in these I roll the grains whilst yet tackey with the varnish. The powder thus prepared is not only improved in appearance, but has greater smoothness and durability than before. After thus coating the grains, I sometimes apply another covering of copal, or other water-proof varnish, being governed in this particular by the nature of the powder, and the purpose to which it is to be applied.

What I claim as my invention, and wish to have secured to me by letters patent, is the giving to the granulated powder a metallic covering, in the manner, and for the purpose, herein set forth.

SAMUEL GUTHRIE.

TRANSLATIONS FROM FOREIGN JOURNALS.

REPORT

To the Board of Directors of Bridges, Public Roads, and Mines, upon the Use of Heated Air in the Iron Works of Scotland and England. *By* M. DUFRENOY, *Engineer of Mines.* *Paris*, 1834.

(Translated for this Journal, by S. V. Merrick.)

Continued from p. 125.

WORKS IN THE ENVIRONS OF GLASGOW.

The vicinity of Glasgow is one vast coal region, the first in Great Britain, both in the extent and the thickness of the veins. This coal basin is also very remarkable for the abundance of its iron ore, both imbedded in the argillaceous schist of the region, and in regular veins, often of considerable extent.

The layers of coal in the vicinity of Glasgow, which belong to the lower strata of the coal formation, alternate with beds of mountain limestone, so that in the same locality, are often united the coal, the

ore, and flux, and often the fire clay used in the construction of the furnaces.

These invaluable advantages are in part compensated by the enormous loss incident to the carbonization of the coal in this locality, as well as by the lightness of the coke produced. From these circumstances, a ton of iron requires at the Glasgow Works for its production, a much larger quantity of fuel than in any district of England.

The employment of the heated air has produced a revolution in the Scotch works, and enabled them to sustain a competition with those of Wales.

Clyde Iron Works were, as before stated, the first in which the heated air was tried. The apparatus now in use (plate 2, figures 1 and 2,) is composed of a double row of horizontal pipes, *a*, *a*, *a*, *a*, 150 feet long. These pipes are nineteen inches in diameter, and one inch and a half thick. The exterior row passes behind the furnace, and enters the other row, dividing the air into two parts; so that the blast is carried equally to each tuyere.

The valves placed at E regulate the distribution of air, and stop either branch when repairs are required.

In the length of 150 feet, the tubes pass through five furnaces, or heaters, F, F, F, F, F, of which two are placed near the tuyeres; so that the air has no time to cool before entering the furnace. Figs. 1 and 2 give an exact idea of the form and disposition of the five heating fires; they are connected by a conduit of brick, *g*, *g*, *g*, which envelopes the pipes; by this means the flame which escapes from the fireplace, circulates about the pipes, and heats their whole length. To preserve the parts of the pipe immediately in contact with the flame, they are encased in fire brick the whole length of the furnace. In the first apparatus of this kind which was constructed, the ends of the pipes were inserted one in the other, having some play to prevent any rupture by expansion; the result was a great loss of air, and the plan was abandoned. Besides, it was remarked, that a great waste always took place at the joints of the pipes; so that it was not sufficient to fasten them with bolts and nuts; the joints were therefore covered with a ring of iron cast on after they were finished. By means of this precaution, the pipes lasted a long time; at the time of my visit, they had been five months in use without repairs.

On the exit pipes are made small holes, V, V, by means of which any change of temperature in the air might be ascertained. This precaution is indispensable, because one of the essential conditions in the use of heated air, is, that its temperature be kept uniform—with this apparatus they raised the air to 612° Fahr., which is higher than the melting point of lead.

In the Clyde Works, two of the four furnaces have each an apparatus like the one described, but in the other two there was no room for the extent of pipes, and they are contracted into smaller space, by being doubled upon themselves.

The working of a furnace with heated air, requires no particular precaution; the operation is the same as before its introduction, the only difference consisting in the substitution of raw coal for coke.

This substitution did not immediately follow the adoption of the new plan; it was some time after, and only when the temperature of the air was raised above the melting point of lead, that the immense benefit of the change was discovered, giving a consequent diminution in the expense of manufacture.

The general idea adopted in Scotland, is, that certain qualities of coal cannot be employed crude, except when the air is highly heated. We have already said that at the Monkland Works, where the air is heated to 460° and 490° Fahr., coke is still used.

The descent of the furnace is very regular—the distances between the charges are nearly equal, the charging being regulated by the space left empty in the throat. The richness of the ore not roasted, varies from 22 to 34 per cent., and the composition of the charges follows this variation. At the time of my visit, the average yield of ore, after roasting, was 44 per cent., and the charges thus composed:

660 lbs. coal,
520 lbs. ore roasted.
100 lbs. lime.

They usually made 40 charges in 24 hours. During the two days that I witnessed the working of the Clyde Works, the number of charges were

July 4—from 6, A. M. to 6, P. M.,		38
from 6, P. M. to 6, A. M.		39
6—from 6, A. M. to 6, P. M.,		37
from 6, P. M. to 6, A. M.,		40

The yield of the furnace in these four castings, was,

t.	cwt.	t.	cwt.	t.	cwt.	t.	cwt.		t.	cwt.
4	8;	4	9;	4	6;	4	12.	Total,	17	15

for 154 charges.

Or, 8 t. 17 cwt. 2 qrs. each 24 hours.

This result shows that a ton of iron is produced at an expense of 2 t. 8 cwt. 2 qrs. coal. The consumption of the heating fire is 8 cwt. Total, 2 t. 16 cwt. 2 qrs. per ton of iron.

The castings are made every twelve hours. The metal obtained is usually a mixture of No. 1 and No. 2. That which goes first from the hearth is No. 1. These two varieties of iron are distinguished by the small channels which furrow the surface of the metal while cooling.

The tuyeres are hermetically closed round with clay, and as they cannot resist the elevated temperature to which they are submitted, water tuyeres have been substituted similar to those used in the fineries. The fig. 3, plate 2, represents the tuyeres employed at the Clyde Works; they are of cast iron, and last various lengths of time, averaging five or six months.

The tuyeres are closed in, to prevent the entrance of cold air through the openings. There is no objection to this arrangement, because the air is so hot, that no scoria accumulates upon the pipe, and the workmen are never obliged to free the tuyeres. There is a high white heat in this part of the furnace; nevertheless there are

scarcely any sparks produced by the oxidation of the iron, and the particles that fall are black in the centre, showing that the metal is still covered with a small layer of melted scoria.

The flame issuing from the furnace is of a bright red, while that from the coke furnace, worked with cold air, is of a yellowish colour. This difference of colour is as marked as that which exists between the flame of alcohol coloured by strontia, and by baryta.

The pressure of the blast in the air vessel, is two pounds and a half, or five inches of mercury to the square inch. It is sensibly the same near the tuyeres, only the gauge which indicates it is subject to great oscillations. This pressure was formerly three pounds. The opening of the tuyere is three inches;—it was two inches and a half when cold air was used. The quantity of air forced into the furnace is less. The blowing engine, of seventy horse power, served only three furnaces; now it feeds four with ease. From the dimensions of the blowing cylinder* the quantity of wind, which was 2827 cubic feet per minute of cold air, is now but 2120 cubic feet.

The furnaces of the Clyde have not been altered since the introduction of hot air. They had been in blast a long time when this new plan was adopted; one of them has been seven years in blast, and the regularity of its operations gives an earnest that it will last a long time.

At the commencement of this report, I have already stated the economy of fuel, and of flux, which had been obtained at the Clyde Works, by the introduction of hot air. I think it, nevertheless, useful to show the correctness of the estimate by transcribing a statement of the different expenses of manufacture during a month, while cold air was used, and a corresponding month, with the use of hot air.

I make this statement from the books of the Works, to which I have been allowed access with a rare liberality.

Consumption and produce of three Furnaces using cold air and coke, during the month of February, 1829.

	Coke.	Ore.	Flux.	Pig Iron.			Castings.	Total.
				No. 1.	No. 2.	No. 3.		
	t. c.	t. c.	t. c.	t. c.	t. c.	t. c.	t. c.	t. c.
1st week	386	227 9	68 2	72 13	32 13	18 13	1 13	125 12
2d do.	411 10	242 11	72 11	51 19	37 11	47 2	6	136 19
3d do.	401	231 16	70 18	44 16	48 2	38 7	3	131 8
4th do.	301 10	177 13	53 6	53	27 9	26 3	0	105 12
	1500	879 9	264 17	222 8	145 15	130 5	2 2	499 11

Add the consumption of the engine, averaging one ton of slack to the ton of iron made.

* The steam engine which works the blowing apparatus, requires for fuel twenty tons of broken coal, or slack, per day of twenty-four hours, which costs one shilling and eight pence, sterling per ton, (forty cents.)

Consumption and produce of four Furnaces, using hot air and coal, during the month of February, 1833.

	Crude Coal.	Ore.	Flux.	Pig Iron.			Castings.	Total.
				No. 1.	No. 2.	No. 3.		
	t. c.	t. c.	t. c.	t. c.	t. c.	t. c.	"	t. c.
1st week	516 15	490 7	91 16	81 4	28 15	155 3	"	265 2
2d do.	514	491 6	91 7	48 8	46 15	161 18	"	257 1
3d do.	521 15	486 8	91 8	94 12	59 10	109 8	"	264
4th do.	470 10	434 12	81 18	75 2	47 10	102 1	"	224 3
	2023	1902 13	356 9	299 6	182 10	528 10		1010 6

The consumption of the steam engine averaged eleven cwt. per ton of iron produced.

The result of an examination of these tables is, that for one ton of iron produced, there was consumed as follows:—

1829. *With Cold Air and Coke.*		1833. *Air Heated to 612° Fahr. and Crude Coal.*	
1. Coal for fusion—	t. cwt.		t. cwt.
3 tons of coke, corresponding to coal, .	6 15	Crude coal, .	2
Do. for steam engine,	1	Do. for steam engine,	11
		Do. for heating the air,	8
	7 15		2 19
2. Ore roasted, 3523 lbs. or	1 15	Ore, 3780 lbs. or	1 18
Its average yield being 57 per cent.		Its average yield being 56 per cent.	
3. Flux, 1056 lbs., or .	10½	Flux, 704 lbs. or .	7
The daily production of the Furnace was			
11,904 lbs. or about six tons.		18,035 lbs., or about nine tons.	

The daily production having been raised at the Clyde Works from six to nine tons. The introduction of hot air has produced an economy in the consumption of fuel, and in the expense of manual labour.

The following table shows the cost of manufacturing pig iron during these two periods:—

	In 1829. Cold Air.		In 1833. Hot Air.	
	t. c.	d. c.	t. c.	d. c.
Coal for melting, at 5*s.* per ton, ($1 20,*)	6 13	8 98	2	2 40
do. for the blowing machine, at 1*s* 8*d.* per ton, (40 cents,)	2	80	11	22
Coal for the heating apparatus,			8	48
Mineral roasted, at 12*s.* per ton, ($2 88,)	1 15	5 04	1 18	5 47
Flux, at 9*s.* per ton, ($2 16,)	10	1 08	7	76
Labour, at 10*s.* per ton, ($2 40,)		2 40		1 60
General expense, int'st. of capital 6*s.* ($1 48,)		1 44		96
Total, . . .		19 74		11 89

* The cost in sterling money is reduced to United States currency at the rate of $4 80 per pound.—Trans.

Calder Iron Works.—These works are three miles from Glasgow, on the Edinburgh Road; the hot air blast has been used at them for three years past; two of the furnaces are fed by an apparatus like that at the Clyde Works, but at the other two, the air is heated by means of a system of small tubes, represented in plate 2, figures 6, 7, 8, and 9.

This apparatus is composed of two large horizontal tubes, *a c*, and *a' c'*, six feet long, nine inches in diameter in the clear, and one inch thick. Nine small tubes, six inches in diameter outside, and three inches inside, doubling upon each other like syphons, are placed vertically upon the pipes, *a c*, and *a' c'*, and fastened, by being driven tight into the throat *d*. This system of tubes is placed in a rectangular furnace, ten feet long, three feet wide, and twelve or fifteen feet high. To prevent injury to the joints, care is taken to protect them from the direct action of the fire. The joint *m*, *n*, of the large pipes is placed outside of the furnace, and the connexions of the small pipes with the large are shielded by fire brick. The flame is carried through the furnace by the longitudinal flue, *g*, *h*, passing the whole length; it is then spread among the tubes which it envelopes, gaining the chimney by the openings *o*, *o*, *o*.

The temperature of the air is raised by this apparatus to 612° Fahr., as at the Clyde Works; the consumption of coal is seven cwt. of coal per ton of iron produced.

This apparatus appears to be preferable to that of the Clyde. It takes less room; the bends in the small tubes, it is true, increase the friction of the air passing through them, but this circumstance appears to have but little influence on its motion. The power expended by the blowing engine is not greater than that at the Clyde Works, and the pressure of the air is two pounds and three-quarters per square inch.

The expense of construction is quite small. The greatest part of it is formed of cast iron, which can be replaced at the works in case of accident. The cost of construction is estimated at about $150, requiring about seven tons of castings—say about one and a half tons for the large pipes, and five and a half tons for the small tubes. By estimating the iron cast into pipes, at $24 per ton, which is the average cost at the works using coal, the expense of each apparatus will be about as follows:

Masonry, - - -	$100
Earthen parts of the furnace,	60
Casting pipes, -	168
	$328

The expense will then be about $656 for each smelting furnace. At Calder they estimate the cost at about $168 to each tuyere. The apparatus at the Clyde is much more expensive;—the quantity of

iron required is seventeen or eighteen tons, and the masonry twelve times as much as at the Calder Works.

The working of the furnaces present the same circumstances as those of the Clyde, and it is useless to repeat them; but to exhibit the progress of the introduction of hot air, we shall indicate,

1. The consumption and products of the Calder Furnace, worked with cold air and coke.

2. The expenses and products of the same furnace, fed with air heated to 300° Fahr., also consuming coke.

3. The same results from the use of hot air and crude coal, during the month of July last.

The results which follow are extracted from the books of the establishment.

Consumption and produce of Furnace No. 3 in 1828, by the Use of the Cold Blast and of Coke.

	Coke.	Ore roasted.	Flux.	Cast Metal.			Total.
				No. 1.	No. 2.	No. 3.	
	t. c. q.	t. c. q.	t. c. q.	t. c.	t. c.	t. c.	t. c.
From 6 Jan. to 3 Feb.	550 2	276 8 0	105 3	95 4	39 1	20 3	154 8
From 3 Feb. to 2 March	545 1	274 5 0	101 1	100 1	34 2	18 2	152 5
From 2 March to 30 do.	575 1	295 6 1	108	106 6	44 3	15 14	166 3
	1670 3 1	845 19 1	314 3 1	301 11	117 6	53 19	472 16
Loss of Coal in coking, 55 per cent.	2041 6 3	563 18 3	Loss of Ore by roasting, 40 per cent.				
Coal, . . .	3711 10 0	1409 18	Ore, Crude—pressure of air, 3¼ lbs.				

Consumption and produce of Furnace No. 3 in 1831. Air heated to 300° Fahr. and Coke.

	Coke.	Ore roasted.	Flux.	Metal.			Total.
				No. 1.	No. 2.	No. 3.	
	t. c.	t. c. q.	t. c. q.	t. c.	t. c.	t. c.	t. c.
From Jan. 2 to 16	189 12	120 3 0	52 10 1	57 11	11	42 2	110 13
From Jan. 16 to 30	204 3	130 6	64 7	46 7		27	73 7
	393 15	250 9	116 17 1	103 18	11	69 2	184
Loss of Coal	481 5	166 19 1	Loss of ore—pressure of air, 3 1-10 lbs.				
Coal	875	417 8 1	Ore crude.				

Consumption and produce of Furnace No. 3 during twelve weeks in 1832 and 1833 by heated air and crude coal.

	Coke.	Ore roasted.	Flux.	Metal. No. 1.	Metal. No. 2.	Metal. No. 3.	Total.
	t. c	t. c. q.	t. c. q.	t. c.	t. c.	t. c.	t. c.
From 4 Nov. to 2 Dec. 1832	406	379 2	65 5	102 15	62	55 10	220 5
From 24 Feb. to 23 March, 1833	458 8	389 6 1	64 7 1	116 10	31	52 10	200
From 24 Mar. to 23 April, 1833	476 4	427 14 1	53 19 1	121 10	36 10	62	220
	1340 12	1166 2 2	183 11 2	340 15	129 10	170	640 5
Loss in Ore		797 8					
Crude Ore		1993 10 2	Pressure of air, 2¾ lbs.				

By comparing these tables, we learn that for one ton of iron produced, the furnace No. 3 consumed as follows:

1828. *Cold air & coke.*	1831. *Air heated to 300° Fahr. and coke.*	1833. *Air heated to 612° Fahr. and coal.*
7075 of coke, corresponding to 15724 lbs. coal, 7 T. 17 cwt.	4279 of coke, corresponding to 9510 lbs., t.cwt. or 4 15	Coal crude,— T. cwt. 4187 lbs. or 2 2 t.cwt.q.
Fuel for heating the apparatus, valued at . .	6	Valued at 8 2 10 0
Ore roasted 3792 lbs. or 1 T. 18 cwt.	—— 5 1	3735 lbs. or 1 17 0
Ore crude 5970 lbs. or 2 T. 19 cwt. 2 q^rs.	2217 lbs. or 1 7	6228 " 3 0 0
Flux 1330lbs. or 13cwt.	4575 " or 2 6	572 " 5 2
	1260 " or 12 2	

NOTE.—The consumption for the steam engine is not considered.

The furnace has produced each twenty-four hours,

1828.	t. cwt.	1831.	t. cwt.	1833.	t. cwt.
Metal, 11,238 lbs.	5 12½	13,143 lbs. or	6 13	16,428 lbs. or	8 4½

The consumption of combustible has, therefore, diminished from 7 t. 17 cwt. to 2 t. 2 cwt., and the amount of flux from 13 cwt. per ton of iron in 1828, to 5½ cwt. in 1833. This diminution must be charged to the increased temperature in the furnace by the use of heated air. I will indicate at the close of this Report, the reasons which appear to me to account for this increase of temperature, the existence of which is certain, though we have not been able to measure it.

The quantity of air blast has been reduced from 3500 cubic feet per minute, to 2627 feet, the pressure being reduced from 3¼ pounds on the square inch, to 2¾ pounds.

The expense of the fuel for heating the air, varies from 7 to 8 cwt. per ton of iron.

The consumption for the blast engine remains the same, but as the yield of the furnace has advanced from 5 tons 12 cwt., to 8 ton 4 cwt., the expense, divided on each ton of iron, is reduced from 1 ton 4 cwt., to 14 cwt.; the slack only is used for this purpose.

The consumption of ore has varied much, but, as the scoria never contains more than from .02 to .015 of iron, this difference depends on the quality of the ore, according as the *Ball ironstone*, (mine en rognous) or *flat ironstone*, (mine en couche) is used.

At Calder, as in the Clyde Works, the daily production of iron has been increased in a great proportion; this circumstance operates powerfully on the price of fabrication, as will be seen by the following statement.

Cost of making one ton of Pig Iron at the Calder Works.

1828. *Cold Air and Coke.*			1833. *Air heated to* 322 *cwt. and Crude*		
t.	*cwt.*	*d. c.*	*t.*	*cwt.* *Coal.*	*d. c.*
7	17½ coal for fusion, at 4*s.* 6*d.* per ton,	8 50	2	2 at 5*s.* per ton,	2 52
1	4 coal for blast engine, at 1*s.* 8*d.* per ton,	48		14 at 1*s.* 8*d.*	28
2	19½ cru le ore, at 6*s.* per ton,	4 25		8 for heating apparatus, at 1*s.* 8*d.*	16
	Expense of roasting, at 10*s.* per ton,	40	1	17 Ore roasted, at 12*s.* per ton,	5 33
13	Flux, at 7*s.* per ton,	1 09		5½ Flux,	46
	Labour, at 10*s.* per ton,	2 40		Labour reduced in proportion to increase of yield,	1 62
	General expense, interest, &c.	1 44		General expense, interest, &c.	1 01
		18 76			11 38

The blast engine employed at Calder is made with two cylinders, one over the other, with one shaft, so that the pistons of both are attached to the same beam. (*tige.*) The upper cylinder is fifty inches, and the lower cylinder seven feet, in diameter, each being seven feet long; the stroke of the piston, which is nine inches thick, is seven feet, and it makes sixteen strokes a minute.

Monkland Iron Works, near Airdrie.

The heating apparatus used at this establishment is similar to that at Calder, being formed with two large pipes, and a number of small tubes, jointed in the large ones, the relative positions being changed.

The two large pipes, *a b*, *a' b'*, (figs. 4 and 5, plate 2,) are vertical, and framed as shown in the plate. The small tubes, *c' c*, five feet long, which make the communication between them, are placed horizontal. This difference of position, and diminished length of the tubes, prevent the temperature of the air from being raised so high as at Clyde, or Calder.

At the time I visited Monkland, the air was heated to 450° Fah., and coke was still in use for smelting.

The economy in fuel and flux obtained at these works, since the introduction of hot air, is nearly the same as at the Calder works, when the air at that furnace was heated to 300° Fahr., and coke still used in the furnace.

Before the adoption of the new plan, the Monkland works consumed from seven to eight tons of coal, for each ton of metal; since that time, there has been consumed,

t.	*cwt.*	
4	0	of coal for smelting;
	6	do. for hot air apparatus;
3	5	crude ore;
	10	flux.

The daily yield is now six tons; the pressure of the blast, two and three quarters of a pound.

The metal produced in the three works of which I have given the details, is, for the most part, intended for the foundry; the No. 3 iron alone is made into bar iron, and for this purpose is sold to the forges near Newcastle.

The pig metal, Nos. 1 and 2, though both destined for the foundries, are not employed indifferently.

The No. 1 iron is principally used for castings, which are to be worked as steam cylinders, &c., or for those requiring great strength. The No. 2 iron, though easily cut with a chisel, is nevertheless harder than the No. 1; it is employed, in preference, for cog wheels, and work requiring considerable hardness.

Besides the works of which I have treated, three others exist in Scotland, using the hot air blast; the results obtained in these establishments, by the adoption of the new plan, being similar to those cited, it appears useless to enter into details respecting them.

Iron Works in the Environs of Newcastle-on-Tyne.

In the coal basin of Northumberland, the largest and richest in the kingdom, which furnishes almost all the fuel used in London, and the vicinity of the Thames, there are but two iron-works:

1st. The *Butterly Iron Works*, six miles from Newcastle, on the London road—the other called the *Tyne Iron Works*, on the banks

of the Tyne, three miles from Newcastle. This region does not abound in good iron ore, and the proprietors have been unable, after the most minute search, to procure mineral enough to supply these two works; but their position on the banks of the Tyne enables them, in spite of these unfavourable circumstances, to draw their supplies from Lancashire and Cornwall, at a cheaper rate than they can be obtained, for the most part, in our iron works.

Both these works have used the heated air for a year past.

The Butterly works, constructed but three years since, contains two furnaces forty-five feet high, four reverberatory furnaces, and several cupolas; all the iron made, is intended for castings.

The results given by the apparatus for heating the air, are not sufficiently important to warrant a particular description and plate. The apparatus consists merely of a tube, returned five times upon itself at right angles, and disposed so that the cross section presents five circles, of which four have for their centres the angles of a rectangular parallelogram, and the fifth the point where the two diagonals intersect.

The tubes are placed horizontally, and are connected by bolts and nuts through lugs on the outside.

The interior diameter of these pipes is fourteen inches, and the metal one and a half inches thick; the length of the heated part is fifty feet, and the pipe is placed in a rectangular furnace, a little shorter than it, so that the joints and angles may not be exposed to the action of the fire.

The expenditure in fuel of this apparatus, is about six hundred weight to the ton of iron produced. The pressure of the air is one and a half pound, being the same as before the introduction of the hot air. The velocity of the blast is a little less.

The charges of the furnace are as follows:

700 lbs. coke, (this coal gives 45 per cent. of coke;)
650 lbs. mineral roasted, being a mixture of equal parts of ore, (*minerai houiller,*) and the red oxide of iron from Lancashire;
400 lbs. flux.

From the register, it appears that there were made, in furnace No. 1,

July 10, 40 charges
" 11, 42 "
" 12, 38 "
} or an average of 40.

The same furnace produced, in these three days, 23 tons 11 cwt. of metal, or a daily average of 7 tons 17 cwt.

By taking this data, we find that, to make one ton of iron at Butterly, they consume,

4 tons of coal for fusion;
6 cwt. coal in lumps to heat the air;
1 ton 13 cwt. ore roasted;
1 ton flux.

The quantity of flux employed is very considerable, because it is much charged with water, being a marly chalk, brought from the banks of the Thames, by the coal ships.

The mixture of ore, when roasted, contains 60 per cent. of iron.

To appreciate the saving which has resulted at the Butterly works, from the use of hot air, it is necessary to know exactly the consumption for a ton of iron, before the introduction of the plan. I have not been able to procure documents which would furnish this; but Mr. J. Hunt, the manager, assured me that the expenditure was seven tons of coal.

If we compare these results with those obtained in Scotland, we shall find that the consumption at Butterly corresponds nearly with that at Calder in 1830, when the temperature of the air was raised to 300° Fahr., and coke was still burned.

At Newcastle, the price of coal forbids its use in the crude state, because the lumps, which are worth one dollar and forty cents the ton, must be used; while the slack, at forty cents, may be used to make coke for this purpose. It is nevertheless advantageous to give the air a higher temperature.

Tyne Iron Works.—The consumptions of material in this work, for the production of a ton of metal, are nearly the same as at Butterly; but an important difference existing between these establishments is, that, at the Tyne works, a great portion of the pig metal is made into malleable iron. This iron, which is of a superior quality, is almost exclusively rolled into boiler plates. In the same furnaces, and with the same minerals, the two kinds of iron are made by varying the relative proportions of ore and coke.

Cupolas are also fed with heated air to great advantage, 225 pounds of coke being sufficient to melt a ton of metal.

The furnaces having been constructed since the adoption of the hot air plan, no comparisons in regard to economy could be instituted.

Environs of Manchester and Liverpool.

The *Rant* iron works, near Wrexham, in Flintshire—the *Apdale*, the *Laneend*, and the *Silverdale* works, near Newcastle-under-Line, Staffordshire—have adopted the hot air plan.

The apparatus used in these establishments, are very like those represented in plate 2, figs. 7 and 8. At Apdale, precisely the same apparatus is used, and the results obtained since its introduction are almost identically the same as at Calder, the temperature of the air being raised to 600 or 612° Fahr.

The consumption of coal, formerly six tons to the ton of iron, is now reduced to three and a quarter tons. They still employ coke, the coal being sulphurous. The expense of the heating apparatus is 7 cwt. of coal to the ton of iron.

The quantity of flux is reduced in the same proportion. In July, when I visited Apdale, only one furnace was in blast, which had been five years at work, but only six months with heated air. Since that time, the yield of the furnace has been from six to seven tons per day; the iron produced being almost all No. 1; while before, the metal had been nearly equal parts of No. 2 and No. 3, the last being made into bar iron.

One work near Newcastle, belonging to Mr. Furnstone, has aban-

doned the use of the hot air blast. I should have endeavoured to ascertain the cause of this, had I learned the fact in time to visit the works.

(*To be continued.*)

¶ *Laws of Motion of Steam Vessels. By* P. W. Barlow, *Esq., Civil Engineer.*

The author commences with the description of a paddle wheel for steam vessels, of a new construction, in which the floats are made to enter and leave the water nearly in a vertical position. He then investigates several formulæ adapted to the calculation of the forces and velocities arising from this form of the apparatus, and gives an account of the results of various experiments made on its efficiency, as compared with the common wheels, and with relation to the consumption of fuel. The general results to which he is led are as follows: 1st. When vessels are so laden as that the wheel is but slightly immersed, little advantage is derived from the vertically acting paddles. 2dly. In cases of deep immersion, the latter have considerable advantage over the wheel of the usual construction. 3dly. In the common wheel, while the paddle passes through the lower portion of the arc, that is, when its position is vertical, it not only affords less resistance to the engine, but is less effective in propelling the vessel than in any part of its revolution. 4thly. The paddle of the wheel, while passing through the lower portion of the arc, affords more resistance to the engine, and is more effective in propelling the vessel, than in any part of its revolution; a property which is a serious deduction from its value; for, in consequence of the total resistance to all the paddles being so much less than in the common wheel, much greater velocity is required to obtain the requisite pressure, and a greater expenditure of steam power is incurred. This loss of power is most sensible when the wheel is slightly immersed; but in cases of deep immersion, the vertical paddle has greatly the advantage. 5thly. In any wheel, the larger the paddles, the less is the loss of force, because the velocity of the wheel is not required to exceed that of the vessel in so great a degree, in order to acquire the resistance necessary to propel the vessel. 6thly. With the same boat, and the same wheel, no advantage is gained by reducing the paddle so as to bring out the full power of the engine; the effect produced being simply that of increasing the speed of the wheel, and not that of the vessel. 7thly. An increase of speed will be obtained by reducing the diameter of the wheel, at least within such limits as allow of the floats remaining sufficiently immersed in the water, and provided the velocity of the engine does not exceed that at which it can perform its work properly. 8thly. An advantage would be gained by giving to the wheel a larger diameter, as far as the immersion of the paddles produced by loading the vessel would not so sensibly affect the angle of inclination of the paddle; but this advantage cannot be obtained with an engine of the same length of stroke, because, in order to allow the engine to make its full number of strokes, it

Fig. 1.

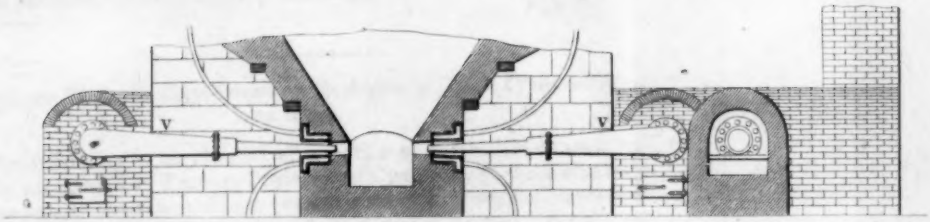


Fig. 4.

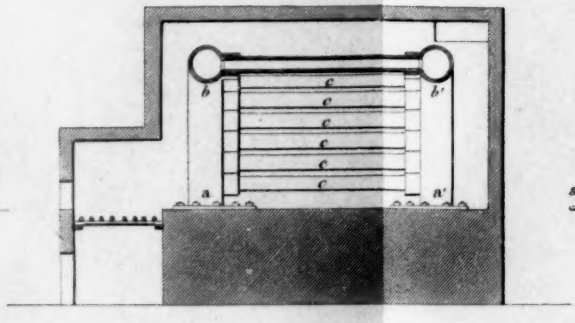


Fig. 5.

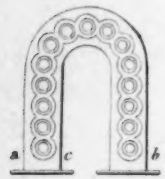


Fig. 2.

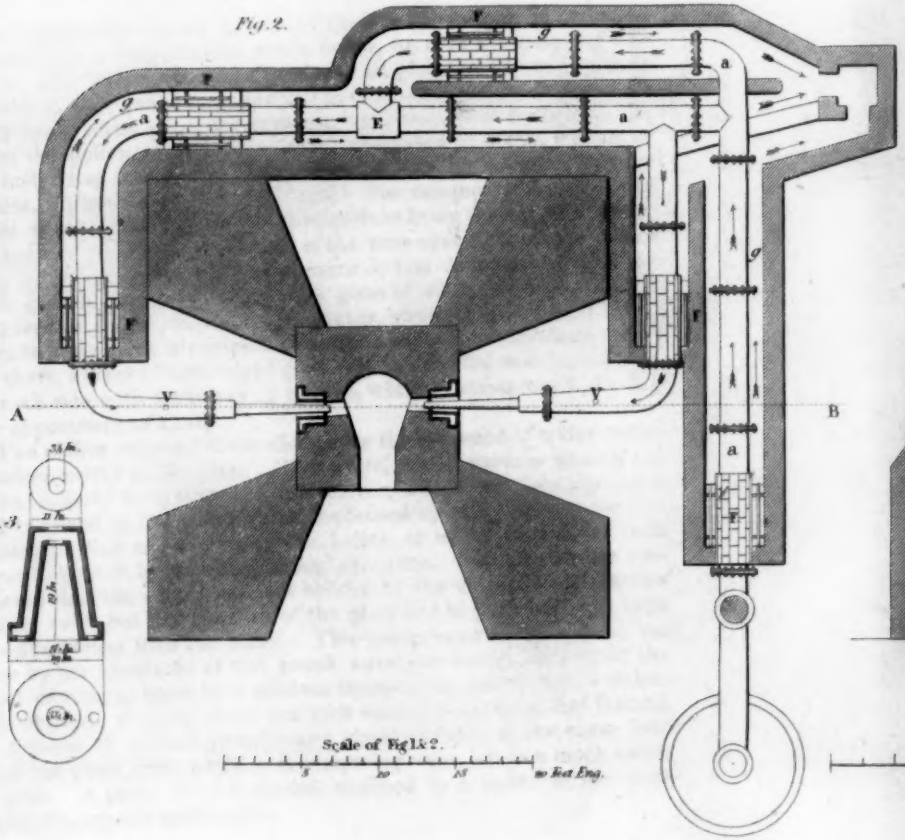


Fig. 3.

Fig. 6.

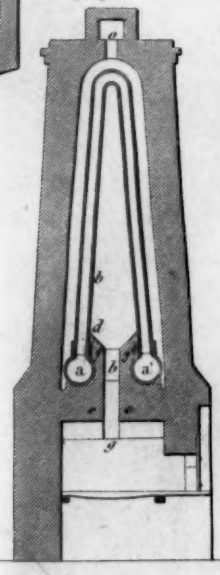


Fig. 7.

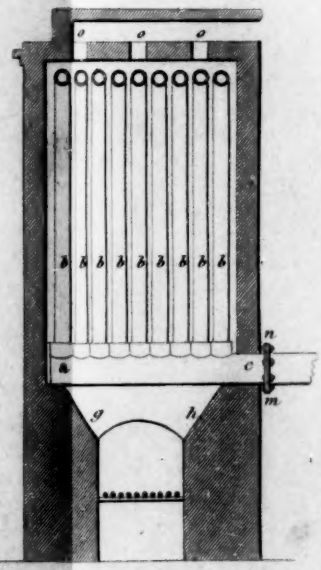


Fig. 8.

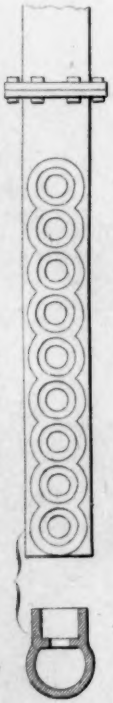
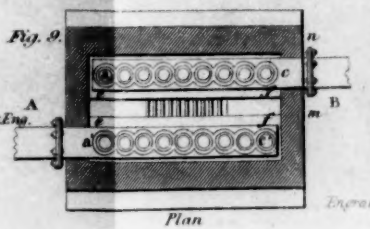


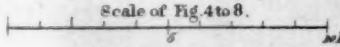
Fig. 9.



Plan

Scale of Fig 1 & 2.

Scale of Fig. 4 to 8.



Engraved by J. Yeager.

will then be necessary to diminish the size of the paddles, which is a much greater evil than having a wheel of smaller diameter with larger paddles.—*Proceedings of the Royal Society.*

[*Rep. Pat. Inv.*

¶*Professor Turner's Experiments on the Action of High Pressure Steam on Glass.*

The following is an abstract of a notice of some experiments recently made by Dr Turner, Professor of Chemistry in the University of London, on the action of high pressure steam on glass and on several other substances, which was read before the Geological Society on the fourth of June last. The facts which it recites will serve further to illustrate the nature of glass, and the circumstances of its decomposition. We shall probably return to the subject on a future occasion.

An opportunity having presented itself to the author, of including substances in a high pressure steam boiler, he took advantage of it to try the effect which would be produced on glass, and he accordingly encased in wire gauze some specimens of plate and window glass [the latter being *crown glass*, we presume,] and suspended them from the top of the boiler, so that they were surrounded by steam whenever the boiler was in action. They were kept in this situation for four months, during which time the boiler was commonly in action ten hours daily, except Sundays, its temperature being then at 300° Fahr. On opening the boiler at the end of the time specified, all the pieces of glass were found to have been more or less decomposed; and the plate glass in particular, which is a glass of silex and soda, was far advanced in decomposition. Flat pieces, one-fifth of an inch thick, were in some parts decomposed through their whole substance; while in others, a layer of unchanged glass was found in the middle, covered on each side with a stratum of opaque, white, siliceous earth, having the appearance of chalk.

The author referred these changes to the influence of water on the alkaline matter of the glass. The white, earthy portions were found to be entirely free from alkaline matter, which had been dissolved and removed by the water which condensed upon the glass at the successive heating and cooling of the boiler, or which may have been thrown upon it by splashing during ebullition. But the author considered that the actual loss was not due to the extraction of alkaline matter only, but that the silex of the glass had in some measure been dissolved along with the alkali. This was proved to have been the case by the apertures of the gauze envelope being filled up at the most depending parts by a silicious incrustation, where also a stalactitic deposite of silica, about one inch and a quarter long, had formed.

A piece of window glass [crown glass] included at the same time with the plate glass, was in a decomposing state, but in a much lower degree. A piece of rock crystal, confined in a boiler at the same time, was wholly unchanged.

The author adduced these facts to illustrate the action of water at high pressures on felspathic and other rocks containing alkaline matters.—*Proceedings of the Geological Society.*

[*Ibid.*

¶ *Rail-road in Egypt.*

A Paris paper contains a letter from Alexandria, which states that this rail-road is to commence at Choubrah, will pass near to Cairo, and thence by the sides of Mokotam, to its termination at Suez. Goods landed at Alexandria, are to be sent by steamboats to Alfe, by the canal of Mack-Modie, and from thence to Choubrah, by the Nile. From Choubrah they will be conveyed by wagons to Suez, whence they will be passed on by steam to Bombay.

[*Lond. Mech. Mag.*

Extract of a Letter to the Editor, from a Correspondent at the University of Virginia, dated Feb. 11, 1835.

"On Saturday night last, the thermometer sank to six degrees, a degree of cold unprecedented, so far as I know, in this place. It may be proper to mention, that the instrument which gave this indication was exposed to the clear sky. Another, also out of doors, but fastened to the inside of a venetian blind, so as to learn the loss of heat by radiation interrupted, did not sink below zero. Observers should be aware of this cause of difference.

During the cold in January, which was so excessive at the north, I did not see the thermometer below + 10°. I am informed that, during the whole of this period, the weather, west of the Allegheny Mountains, in this State, was quite mild. I do not know, indeed, of any thermometrical observations, but the extraordinary fact is sufficiently shown by the circumstance, that there was no ice for the ice houses, and that great uneasiness was expressed lest the usual supply of this luxury for the next summer, should fail. You know that the climate is generally much colder to the west than to the east of the mountains in this State."

List of American Patents which issued in January, 1835.

	Jan.
1. Cooking Stove.—Abraham Spoor, Coxsackie, New York,	7
2. Stoves for anthracite. do. do. do.	7
3. Churn.—Iram Brewster, Schoharie county, New York,	7
4. Thrashing machine.—Luke Hall, Hollis, New Hampshire,	7
5. Cooking stove.—Eliphalet Nott, Schenectady, New York,	7
6. Covering vessels with caoutchouc.—George D. Cooper, N. York city,	7
7. Pendulum lever engine.—Sidney Woods, Freeport, Maine,	7
8. Cutting clothes.—Allen Ward, Philadelphia,	7

		Jan.
9.	Churn, spiral spring.—Lewis Hinkson, Hallowell, Maine,	7
10.	Cotton gins, improved.—Wm. S. Cooley, Norwich, Connecticut,	7
11.	Woodworth's planing machine, improved.—Artemas L. Brooks, Lowell, Massachusetts,	7
12.	Ink distributor.—John Maxson, Schenectady, New York,	9
13.	Portable press.—Alex. J. Murray, Annapolis, Maryland,	9
14.	Mills, propelling by weights.—Obed R. Marston, Java, New York,	9
15.	Churn.—Francis Colton, New York city,	9
16.	Cylinder pump, double acting.—Phelps Mix, Germantown, Pa.	9
17.	Window springs.—Munro L. Stevens, Waterbury, Conn.	9
18.	Open stove, &c.—Elias W. Newton, Middletown, Connecticut,	9
19.	Stoves, manufacturing. do. do. do.	9
20.	Rake tooth machine.—G. Dayton & W. Stedman, Blanford and Springfield, Massachusetts,	9
21.	Rotary steam engine.—Ethan Baldwin, Washington city,	9
22.	Nail machine nippers.—Stephen Chubback, Wareham, Mass.	9
23.	Horse power.—Irby Jones, Natchez, Miss.	9
24.	Cracking coffee berries.—Isaac Adams, Boston, Mass.	9
25.	Cracking coffee husks.—Thomas Ditson, Boston, Mass.	9
26.	Percussion cannon lock.—Robert Beale, city of Washington,	13
27.	Clover seed, hulling.—Stacy West, Hartford county, Maryland,	16
28.	Churning and washing machine.—Ira Parke, Delhi, New York,	16
29.	Dyspepsia machine.—Charles Wood, New Bedford, Mass.	16
30.	Cooking stove.—Sylvester Parker, Troy, New York,	16
31.	Cooking stove.—John Iggett, Albany, New York,	16
32.	Stump extractor.—Henry Gordon, Fountain Dale, New York,	16
33.	Washing machine.—Stillman Roberts, Portland, Maine,	16
34.	Horse power band.—J. L. Stanly and J. C. Howard, Winthrop, Maine,	16
35.	Currying knife trimmer.—Luther Townsend, Farmington, Maine,	16
36.	Sausage machine.—J. Burns and J. Walton, Waynesboro, Pa.	16
37.	Trunks and settees.—Benj. Morris, N. Richmond, Ohio,	16
38.	Bee-hive.—Samuel Morrill, Dixfield, Maine,	16
39.	Iron furnaces, anthracite.—M. Brooke Buckley, Pottsville, Pa.	16
40.	Bedstead machine.—Aaron Stedman, Pittsford, New York,	16
41.	Hoops and masts, &c. bending.—Jonathan Mulford, N. Liberties, Pa.	16
42.	Corn shelling machine.—Robert Gray, Northfield, New Hampshire,	16
43.	Grist Mill.—Hezekiah and Pouncey Nichols, Barren county, Ky.	21
44.	Stave saw.—Harvey Holmes, N. Marlborough, Mass.	21
45.	Straw cutter.—Nimrod Murphree, Nashville, Tenn.	21
46.	Water cisterns.—Levi Kidder, New York city,	21
47.	Barrel machine.—John Squier, Saline, New York,	21
48.	Press for hay and cotton.—Eben. Eliason, Jr., Fredericksburg, Va.	21
49.	Truss hoops.—T. and S. Burgess, Livonia, New York,	21
50.	Fireplace.—Ansel Gerrish, Shopleigh, Maine,	23
51.	Smut and garlic machine.—Abraham Hurst, Allen township, Pa.	23
52.	Thrashing and cleaning machine.—Alexander Porter, New Vineyard, Maine,	23
53.	Stove for anthracite.—Jacob J. Janeway, New Brunswick, N. Jersey,	27
54.	Setting awl blades, &c.—E. B. Bigelow and S. P. Brigham, Boylston, Massachusetts,	27
55.	Rotary pump.—Wm. C. Trowbridge, South East, New York,	27
56.	Propelling boats.—Philip E. Barbour, Louisville, Kentucky,	27
57.	Mill, farmers'.—John R. Sleeper, city of Philadelphia,	27

CELESTIAL PHENOMENA, FOR APRIL, 1835.

Calculated by S. C. Walker.

Day.	H'r.	Min.			
2	7	11	N. App. 53 Tauri, ,6,7, and ☽, ✱	N. 1′,6	
4	11	25	Im. 5 Geminorum,	,7, N. 26°	V. 78°
4	11	57	Em.	324°	14°
10	13	23	N. App. ♑ Virginis, and ☽, ✱	N. 3,′5,	
12	6	13	Im. 65 Virginis,	,6, 33°	345°
12	7	7	Em.	265°	216°
12	6	58	Im. 66 Virginis,	,6, 100°	50°
12	7	42	Em.	210°	162°
30	8	41	N. App. Jupiter's Centre, and ☽,	☽ N. 7,′4	

Meteorological Observations for December, 1834.

Moon.	Days.	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inches.	Inches.			Inches.	
☽	1	31°	48°	30.10	30.05	SW. S.	Calm		Clear—lightly cloudy—rain in n't.
	2	40	45	29.60	29.60	S. SE.	Moderate.	0.27	Rain—drizzle.
	3	32	40	.70	.75	W.	Brisk.		Lightly cloudy.
	4	25	36	30.20	30.25	W.	Moderate.		Clear day.
	5	26	46	.15	.15	W. SW.	do.		Clear—hazy—rain in night.
	6	52	50	29.40	30.00	W. SW.	Brisk.	1.00	Rain—cloudy.
	7	36	46	30.00	30.00	W. SW.	Moderate.		Clear day.
	8	46	48	29.60	29.55	SW. W.	Brisk.		Cloudy—lightly cloudy.
	9	29	36	30.15	30.20	W.	Moderate.		Clear—cloudy.
	10	24	34	.35	.35	S. SW.	do.		Clear day.
	11	24	42	.05	29.95	W.	do.		Clear day.
	12	32	36	29.95	.90	SW.	do.		Cloudy day.
	13	32	40	.60	.65	W. NW.	Brisk.		Cloudy day.
	14	36	50	.56	30.00	NW.	Blustering		Cloudy—clear at 10 P. M., therm.
	15	7	18	30.00	.65	W.	do.		Cloudy—sun eclipsed. [5 above 0.
☉	16	28	50	29.65	.70	NW.	Moderate.		Lightly cloudy—clear.
	17	16	21	30.20	30.30	NE.	do.		Lightly cloudy.
	18	24	30	.15	.15	NE.	do.		Cloudy day.
	19	30	36	.26	.26	NE.	do.		Cloudy day.
	20	30	36	.00	.00	SW.	do.		Cloudy day.
	21	32	36	.10	.15	W.	do.		Cloudy day.
	22	26	40	.10	.10	SE. SW.	do.		Cloudy day.
	23	30	42	.10	.15	W.	do.		Cloudy day.
	24	30	30	.10	29.90	E.	do.	0.33	Cloudy—lightly cloudy.
☽	25	30	31	29.77	.75	SW.	do.		Sleet—drizzle—rain.
	26	16	30	.95	.90	NE.	do.		Cloudy day.
	27	30	30	.90	30.00	W.	do.		Snow.
	28	29	29	30.10	.15	SE.	do.		Cloudy day.
	29	26	35	29.90	29.80	NE.	Brisk.	0.75	Snow.
	30	26	37	.70	.70	W.	Moderate.		Cloudy day.
⊗	31	30		.70	.90	W.	do.		Cloudy—lightly cloudy.
	Mean	28.57	36.03	29.94	29.94			2.35	

Thermometer.		Barometer.
Maximum height during the month,	52. on 6th,	30.35 on 10th.
Minimum do.	7. on 15th.	29.40 on 6th.
Mean do.	32.30	29.94

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

APRIL, 1835.

Address upon a proposed Rail-road from Wilmington to the Susquehanna, together with a Report of the Survey made by William Strickland, Esq., Architect and Engineer.

(WITH A MAP.)

The route through Wilmington, Elkton, North East, and Charlestown, to the Susquehanna river, has been, from the earliest settlement of the country, an established route in the great chain of communication running through Philadelphia and Baltimore. It is the shortest road between these two cities, and, until the establishment of the steamboat and rail-road line through Newcastle and Frenchtown, was the most expeditious, and, as such, was the regular route for the transportation of the United States Mail. In the winter season, when navigation ceases, it is still the line by which that mail travels. The peculiar advantages which this route possesses over all others, points it out as the natural thoroughfare over the peninsula, available at all seasons of the year, the shortest, and, when the proper artificial means are applied, the most expeditious. Convinced of these facts, the attention of intelligent individuals in Wilmington has for many years been directed to the subject of a rail-road communication along this route, as one which would at once unite great public convenience and utility, with a profitable investment of capital. An act of incorporation was obtained from the legislature of Delaware, in the year 1832, authorising a company, with a competent capital, to construct a rail-road from Wilmington to the line of the state of

CELESTIAL PHENOMENA, FOR APRIL, 1835.

Calculated by S. C. Walker.

Day.	H'r.	Min.				
2	7	11	N. App. 53 Tauri, ,6,7, and ☽, ✱ N. 1′,6			
4	11	25	Im. 5 Geminorum,	,7,	N. 26°	V. 78°
4	11	57	Em.		324°	14°
10	13	23	N. App. ρ Virginis, and ☽, ✱ N. 3,′5,			
12	6	13	Im. 65 Virginis,	,6,	33°	345°
12	7	7	Em.		265°	216°
12	6	58	Im. 66 Virginis,	,6,	100°	50°
12	7	42	Em.		210°	162°
30	8	41	N. App. Jupiter's Centre, and ☽, ☽ N. 7,′4			

Meteorological Observations for December, 1834.

Moon.	Days.	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inches	Inches			Inches.	
☾	1	31°	48°	30.10	30.05	SW. S.	Calm.		Clear—lightly cloudy—rain in n't.
	2	40	45	29.70	29.60	S. SE.	Moderate.	0.27	Rain—drizzle.
	3	32	40	.70	.75	W.	Brisk.		Lightly cloudy.
	4	25	36	30.30	30.25	W.	Moderate.		Clear day.
	5	26	46	.15	.15	W. SW.	do.		Clear—hazy—rain in night.
	6	52	50	29.40	29.40	SW.	Brisk.	1.00	Rain—cloudy.
	7	36	46	30.00	30.00	W. SW.	Moderate.		Clear day.
	8	46	48	29.60	29.55	SW. W.	Brisk.		Cloudy—lightly cloudy.
	9	29	36	30.15	30.20	W.	Moderate.		Clear—cloudy.
	10	24	34	.35	.35	S. SW.	do.		Clear day.
	11	24	42	.05	29.95	W.	do.		Cloudy day.
	12	32	36	29.95	.90	W.	do.		Cloudy day.
	13	32	40	.60	.65	SW.	Brisk.		Cloudy day.
	14	36	20	.56	.65	W. NW.	Blustering		Cloudy—clear at 10 P. M., therm.
	15	7	18	30.00	.95	NW.	do.		Cloudy—sun eclipsed. [5 above 0.
☉	16	28	50	29.65	.70	W.	Moderate.		Lightly cloudy.
	17	16	21	30.20	30.30	NE.	do.		Cloudy day.
	18	24	30	.15	.15	NE.	do.		Cloudy day.
	19	30	36	.36	.30	NE.	do.		Cloudy day.
	20	30	30	.00	.00	SW.	do.		Cloudy day.
	21	32	36	.10	.15	W.	do.		Cloudy day.
	22	26	40	.30	.10	SE. SW.	do.		Cloudy day.
	23	30	42	.10	.15	W.	do.		Cloudy—lightly cloudy.
	24	30	20	29.77	29.90	E.	do.	0.33	Sleet—drizzle—rain.
☽	25	30	31	.55	.75	SW.	do.		Cloudy day.
	26	16	30	.90	.90	NE.	do.		Snow.
	27	30	30	30.00	.90	W.	do.		Cloudy day.
	28	29	29	30.10	.15	SE.	do.		Cloudy day.
	29	26	29	29.90	29.80	NE.	Brisk.	0.75	Snow.
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	Mean	28.57	36.03	29.94	29.94			2.35	

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